# The Journal of Parasitology

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## PROGRAM AND ABSTRACTS OF THE TWENTY-SECOND ANNUAL MEETING OF THE AMERICAN SOCIETY OF PARASITOLOGISTS

### CHICAGO, ILLINOIS

December 29, 30, and 31, 1947

### *PROGRAM*[1]

MONDAY MORNING SESSION, DECEMBER 29, 9:00 AM, CONGRESS HOTEL (FRANCIS I ROOM).

*Read*

1. Potassium in Relation to Death in Rats Injected with *Trypanosoma equiperdum*. (10 min) GEORGE J. SCHEFF AND JONATHAN S. THATCHER, Chicago Medical School and Ohio State University.

2. Studies on *Bodo foetus* (Protozoa: Mastigophora). (10 min) (Lantern) BANNER BILL MORGAN, University of Wisconsin.

3. Cultivation of *Trichomonas gallinarum* in the Chick Embryo and *in vitro* with Single Strains of Certain Bacteria. (10 min) (Lantern) R. M. CABLE AND EMMA HILLAERT, Department of Biology and Department of Veterinary Science, Purdue University, Lafayette, Indiana.

4. Strains of *Trichomonas gallinae* Varying in Virulence. (7 min) (Lantern) ROBERT M. STABLER, Colorado College.

5. Infection with a Less Virulent Strain of *Trichomonas gallinae* as a Protection against a More Virulent One. (8 min) (Lantern) ROBERT M. STABLER, Colorado College.

6. Unisexual Infections with *Schistosomatium douthitti* (Trematoda). (10 min) ROBERT B. SHORT, University of Michigan.

7. Penetration Glands in Cyclophyllidean Onchospheres. (10 min) (Lantern) W. MALCOLM REID, Monmouth College.

8. Observations on Experimental Dermatitis in Humans Induced by Cercariae of *Trichobilharzia stagnicolae* (Talbot, 1936). (15 min) (Lantern) LOUIS OLIVIER, National Institute of Health.

9. Notes on the Life Cycle of *Schistocephalus* sp., a Tapeworm from Gulls. (10 min) (Lantern) LYELL J. THOMAS, University of Illinois.

10. The Sedimentation Rate of Erythrocytes in Malaria Infections and Its Correlation with the Electrophoretic Mobility. (15 min) (Lantern) W. B. REDMOND AND W. S. POLLITZER, Emory University.

[1] An alphabetical author index will be found at the end of the program. Extra copies of this Supplement, and portraits of parasitologists, will be on sale at the meeting.

11. Coccidia of the Mink. (10 min) (Lantern) NORMAN D. LEVINE, University of Illinois.

12. The Effect of Sulfaquinoxaline on the Developmental Stages of *Eimeria tenella*. (10 min) (Lantern) ASHTON C. CUCKLER AND WALTHER H. OTT, Merck Institute for Therapeutic Research, Rahway, New Jersey.

13. Observations on *Leucocytozoon* Infections in Birds Receiving Paludrine, Atebrin, and Sulphamerazine. (10 min) (Lantern) A. MURRAY FALLIS, Ontario Research Foundation, Toronto.

14. A New Ruling for the Ocular Disc of Special Usefulness in the Teaching of Medical Parasitology. (5 min) (Lantern) (Also by demonstration) EDWARD P. OFFUTT, University of Rochester.

MONDAY AFTERNOON SESSION, DECEMBER 29, 2:00 PM, CONGRESS HOTEL (FRANCIS I ROOM).

*Read*

15. The Metabolism of Mammalian Trypanosomes and their Classification. (10 min) (Lantern) THEODOR VON BRAND AND ELEANOR JOHNSON TOBIE, National Institute of Health.

16. Studies on Experimental Blackhead Infection in Turkeys. (10 min) (Lantern) FRANCIS MCKAY AND NEAL F. MOREHOUSE, Dr. Salsbury's Laboratories, Charles City, Iowa.

17. The Taxonomic Value of the Gnathasome in Certain Laelaptine Mites. (10 min) (Lantern) R. W. STRANDTMANN, University of Texas.

18. The Resistance of Certain Adult Ducks to Infection of the Avian Malaria Parasite *Plasmodium lophurae*. (10 min) (Lantern) WILLIAM TRAGER, Rockefeller Institute for Medical Research.

19. Immunity in Avian Malaria in Relation to Severity of Infection. (10 min) (Lantern) WENDELL GINGRICH, University of Texas.

20. Progress Report on the Parasitic Stages of *Chabertia ovina*. (15 min) (Lantern) (Also by demonstration) W. L. THRELKELD, Virginia Agricultural Experiment Station, Blacksburg, Virginia.

21. What is a Virgula in Virgulate Cercariae? (15 min) (Motion picture) (Also by demonstration) FRANCIS KRUIDENIER, University of Michigan.

22. Quantitative Hookworm Diagnosis by Direct Smear. (15 min) (Lantern) (Also by demonstration) PAUL C. BEAVER, Tulane University.

23. A Method of Testing the Effect of Substances upon the Activity of the Larger Nematodes. (10 min) (Lantern) K. B. KERR AND J. W. CAVETT, Dr. Salsbury's Laboratories, Charles City, Iowa.

24. Immunity in Chickens to *Ascaridia galli*. (15 min) (Lantern) ELVIO H. SADUN, Johns Hopkins University.

25. Factors in the Resistance of White Rats to Infection with the Cotton Rat Filariids. (15 min) (Lantern) J. ALLEN SCOTT, University of Texas.

26. Comparative Filaricidal Activity of Trivalent Arsenic and Antimony. (15 min) (Lantern) G. F. OTTO AND T. H. MAREN, Johns Hopkins University.

TUESDAY MORNING SESSION, DECEMBER 30, 9:00 AM, CONGRESS HOTEL (FRANCIS I ROOM).

*Read*

27. Resumption of the Reproductive Phase of *Trypanosoma lewisi* in Recovered and Near-Recovered Rats Following both Reinoculation with the Parasite and Treatment with Sodium Salicylate. (15 min) (Lantern) ELERY R. BECKER AND MICHAEL G. LYSENKO, Iowa State College.

28. An Effective New Coccidiostatic. (15 min) (Opaque projection) PAUL D. HARWOOD, DOROTHY I. STUNZ, AND ROBERT WOLFGANG, Dr. Hess and Clark, Inc., Ashland, Ohio.

29. A Method for Screening Anti-Malarial Drugs in the Mosquito Host. (15 min) (Lantern) LEVON A. TERZIAN, Naval Medical Research Institute.

30. Observations on Orbatid Mites, Vectors of *Moniezia expansa* on Pastures, with a Report of Several New Vectors from the United States. (15 min) (Lantern) (Also by demonstration) K. C. KATES AND C. E. RUNKEL, U. S. Bureau of Animal Industry.

31. The Relationship between Trombiculid and Trombidiid Mites. (15 min) (Lantern) G. W. WHARTON, Duke University.

32. Extended Persistence of Oöcysts of *Plasmodium relictum* in Culture. (10 min) (Lantern) GORDON H. BALL, University of California at Los Angeles.

33. The Infectivity of Native Malarias in South Carolina to *Anopheles quadrimaculatus*. (10 min) (Lantern) MARTIN D. YOUNG, NEWTON F. HARDMAN, ROBERT W. BURGESS, WILLIAM C. FROHNE, AND CURTIS W. SABROSKY, U. S. Public Health Service.

TUESDAY MORNING SESSION, DECEMBER 30, 11:00 AM, CONGRESS HOTEL (FRANCIS I ROOM).

*Presidential Address*

34. Expanding Horizons in the Recognition of a Phylum. HARLEY J. VAN CLEAVE, University of Illinois.

TUESDAY, DECEMBER 30.

12:30 PM, PARASITOLOGISTS LUNCHEON.

1:30 PM, ANNUAL BUSINESS MEETING.

TUESDAY AFTERNOON SESSION, DECEMBER 30, 3:00 PM, CONGRESS HOTEL (FRANCIS I ROOM).

*By Demonstration*

14. A New Ruling for the Ocular Disc of Special Usefulness in the Teaching of Medical Parasitology. (Also read) EDWARD P. OFFUTT, University of Rochester.

20. Progress Report on the Parasitic Stages of *Chabertia ovina*. (Also read) W. L. THRELKELD, Virginia Agricultural Experiment Station, Blacksburg, Virginia.

21. What Is a Virgula in Virgulate Cercariae? (Also read) FRANCIS KRUDENIER, University of Michigan.

22. Quantitative Hookworm Diagnosis by Direct Smear. (Also read) PAUL C. BEAVER, Tulane University.

30. Observations in Orbatid Mites, Vectors of *Moniezia expansa* on Pastures, with a Report of Several New Vectors from the United States. (Also read) K. C. KATES AND C. E. RUNKEL, U. S. Bureau of Animal Industry.

35. The Trematode Genus *Tamerlania* in Resident Birds of the United States. ELON E. BYRD, University of Georgia.

36. Mucin in Developing Digenetic Trematodes. FRANCIS J. KRUIDENIER, University of Michigan.

37. Some Effects of Acanthocephala on the Large-Mouthed Black Bass. CARL E. VENARD AND JOHN H. WARFEL, Ohio State University and Western Reserve University.

38. A Method for Relaxing and Fixing Large Cestodes. ROBERT L. ROUDABUSH, Ward's Natural Science Establishment, Inc.

53. The Phase Microscope in the Examination of *Endamoeba*. (Also read) ERNEST HARTMAN AND GEORGE F. SCHEFF, Chicago Medical School.

WEDNESDAY MORNING SESSION, DECEMBER 31, 9:00 AM, CONGRESS HOTEL (FRANCIS I ROOM).

*Read*

39. Mammalian Blood Flukes of Celebes. (10 min) (Lantern) ERNEST CARROLL FAUST, Tulane University, AND C. BONNE, Universiteit van Indonesie, Batavia, Java.

40. Germinal Masses in the Rediae of the Trematode Order Fasciolatoidea Szidat, 1936. (15 min) (Lantern) W. W. CORT, D. J. AMEEL, AND ANNE VAN DER WOUDE, Johns Hopkins University, Kansas State College, and University of Michigan.

41. Germinal Material in Mother Sporocysts and Rediae of *Halipegus eccentricus* Thomas, 1939. (10 min) (Lantern) D. J. AMEEL, W. W. CORT, AND ANNE VAN DER WOUDE, Kansas State College, Johns Hopkins University, and University of Michigan.

42. *Porocephalus crotali* Humbolt (Pentastomida) in Oklahoma. (8 min) (Lantern) J. TEAGUE SELF, University of Oklahoma.

43. Additional Infection Experiments with the Hookworm, *Bunostomum phlebotomum*, in the Calf. (15 min) ROY L. MAYHEW, Louisiana State University.

44. On Certain Pseudophyllidean Cestodes from Alaskan Pinnipeds. (12 min) HORACE W. STUNKARD, New York University.

45. Nature of Duodenal Nematode Growth-Inhibiting Factor. (10 min) (Lantern) LYMAN P. FRICK AND J. E. ACKERT, Kansas State College.

46. Further Studies on Hydrogen-Ion Concentration as a Factor in Age Resistance to the Fowl Ascarid. (10 min) (Lantern) B. B. RIEDEL AND J. E. ACKERT, Kansas State College.

47. Age of *Ascaridia* Egg Cultures a Factor in Worm Growth. (5 min) (Lantern) J. E. ACKERT, RHODA W. COOPER, AND L. W. DEWHIRST, Kansas State College.

48. The Status of the Sodium Fluoride Treatment for the Removal of Large Roundworms from Swine. (15 min) (Lantern) A. O. FOSTER, F. D. ENZIE, R. T. HABERMANN, AND R. W. ALLEN, U. S. Bureau of Animal Industry.

49. Screening Large Numbers of New Chemical Compounds for Anthelminthic Activity Using Infections of *Nippostrongylus muris* in Mice. (15 min) (Lantern) STERLING BRACKETT AND ALEXANDER BLIZNICK, American Cyanamid Company, Stamford, Connecticut.

50. Further Studies on the Maintenance of Cultures of *Endamoeba histolytica* without Viable Bacteria. (10 min) (Lantern) LEON JACOBS, National Institute of Health.

51. Studies on the Growth Requirements of Metacystic *Endamoeba histolytica.* (10 min) (Lantern) CHARLES W. REES AND LUCY V. REARDON, National Institute of Health.

52. Culture Experiments on Intestinal Flagellates. IV. Selected Longevity Records to September 15, 1947. (15 min) (Lantern) D. H. WENRICH, University of Pennsylvania.

53. The Phase Microscope in the Examination of *Endamoeba.* (7 min) (Also by demonstration) ERNEST HARTMAN AND GEORGE J. SCHEFF, Chicago Medical School.

54. The Fate of Various Species of Trypanosomes in *Triatoma.* (10 min) (Lantern) A. PACKCHANIAN, University of Texas.

55. Studies of Sheep Parasites. VIII. Overwintering of Nematode Larvae (10 min) (Lantern) PHILIP A. HAWKINS AND MOACYR G. DE FREITAS.

*By Title*

56. The Effect of Aralen on *Giardia lamblia* Infections in Children. J. C. SWARTZWELDER AND T. C. PAPERMASTER, Louisiana State University.

57. Bite of *Amblyomma americanum* Associated with Possible Tick Paralysis. J. C. SWARTZWELDER AND J. H. SEABURY, Louisiana State University.

58. Report of Ten Cases of *Balantidium coli* Infection. J. C. SWARTZWELDER, Louisiana State University.

59. The Life History and Bionomics of *Heterakis bonasae,* a Cecal Nematode of Bobwhite Quail, *Colinus virginianus* and *C. virginianus texanus.* J. W. WARD, University of Mississippi.

60. Further Taxonomic Studies on Internal Parasites of Horses and Mules. J. W. WARD, University of Mississippi.

61. Studies on Parasites and Food Habits of Foxes. J. W. WARD, University of Mississippi.

62. Longevity and Rates of Infectivity of the Free-Swimming Miracidia of *Schistosoma mansoni.* JOSE F. MALDONADO AND J. ACOSTA-MATIENZO, School of Tropical Medicine, San Juan, Puerto Rico.

63. An Investigation of Some Possible Sources of Trichina Infection in a Central Illinois Community. WAYNE W. WANTLAND AND PAUL MARTIN, Illinois Wesleyan University.

64. The Localization of Adult *Trichinella spiralis* in the Intestinal Tract of Young and Old Mice. JOHN E. LARSH, JR. AND JAMES R. HENDRICKS, University of North Carolina.

65. The Effect of Thyroid and Thiouracil on the Natural Resistance of Mice to Infection with *Hymenolepis.* JOHN E. LARSH, JR., University of North Carolina.

66. The White Rat and the Guinea Pig as Hosts for the Larvae of the Brown Dog Tick, *Rhipicephalus sanguineus.* GEORGE W. LUTTERMOSER, University of Pennsylvania.

67. Susceptibility and Immunity of Marine Fishes to *Benedenia* (= *Epibdella*) *melleni* (MacCallum), a Monogenetic Trematode. III. Natural Hosts in the West Indies. Ross F. NIGRELLI, New York Aquarium, New York Zoological Society.

68. Parasites of the Ranidae (Amphibia). I. A. C. WALTON, Knox College.
69. Parasites of the Ranidae (Amphibia). II. A. C. WALTON, Knox College.
70. Parasites of the Ranidae (Amphibia). III. A. C. WALTON, Knox College.

WEDNESDAY AFTERNOON SESSION, DECEMBER 31, 2:00 PM, CONGRESS HOTEL (FRANCIS I ROOM).

**Symposium on Exoerythrocytic Forms of Malarial Parasites**

71. Introduction. CLAY G. HUFF, Naval Medical Research Institute.

72. A Search for the Pre-erythrocytic Stages of *Plasmodium vivax* and of *P. cynomolgi*. CLAY G. HUFF AND FREDERICK COULSTON, Naval Medical Research Institute, and E. I. du Pont de Nemours and Company.

73. The Chemotherapy of Malaria in Relation to Our Knowledge of Exoerythrocytic Forms. G. ROBERT COATNEY AND W. CLARK COOPER, National Institute of Health.

74. The Chemotherapy and Immunology of Pre-erythrocytic Stages in Avian Malaria. FREDERICK COULSTON AND CLAY G. HUFF, E. I. du Pont de Nemours and Company and Naval Medical Research Institute.

75. RICHARD JANVIER PORTER, University of Michigan. (Invited Paper; No Abstract Received.)

76. Response of Exo-erythrocytic Forms to Alterations in the Life Cycle of *Plasmodium gallinaceum*. VICTOR H. HAAS, AIMEE WILCOX, R. L. LAIRD, FRANCES MOORE EWING, AND NELL COLEMAN, National Institute of Health and University of Tennessee.

# AUTHOR INDEX

Showing program number, which is also abstract number of each paper.

## ABSTRACTS

1. *Potassium in Relation to Death in Rats Infected with* Trypanosoma equiperdum. GEORGE J. SCHEFF AND JONATHAN S. THATCHER, Chicago Medical School and Ohio State University.

Potassium tolerant and non-tolerant rats were studied with respect to the progress of the parasite count and survival time following infection with *Trypanosoma equiperdum.* From the observation that in both groups of animals the course of the infection was practically the same, it appears that potassium is not the causative agent of death in this disease as claimed by some recent investigators.

2. *Studies on* Bodo foetus (*Protozoa: Mastigophora*). BANNER BILL MORGAN, University of Wisconsin.

*Bodo foetus,* a flagellate originally isolated and described by Koffman (1937) from aborted bovine fetuses in Sweden, has been found to be the most common contaminant in samples collected for the diagnosis of bovine trichomoniasis. Attempts to isolate *B. foetus* in bacteria-free cultures have been negative. This flagellate has been maintained in the laboratory for four years in association with a single species of bacteria (*Proteus* sp.) by weekly transfers. *Bodo foetus* grows best at 30° C in egg slants overlaid with Ringer's solution or in a medium composed of peptone, ammonium nitrate, sodium acetate, potassium phosphate, magnesium sulfate and distilled water. The optimum pH is 6.6. *Bodo foetus* will die within 24 to 36 hours at 37° C. Inoculations (intravenous, intramuscular, intraperitoneal and subcutaneous) of small laboratory animals were routinely negative. Vaginal inoculations into cows were also negative. It was concluded that *B. foetus* is a non-pathogenic, coprozoic flagellate.

3. *Cultivation of* Trichomonas gallinarum *in the Chick Embryo and* in vitro *with Single Strains of Certain Bacteria.* R. M. CABLE AND EMMA HILLAERT, Purdue University.

*Trichomonas gallinarum* was grown in the chorio-allantoic fluid of living chick embryos injected with the cecal contents of infected turkeys and protected against massive bacterial infection by the addition of 5000 units of penicillin/cc of inoculum. Flagellates persisted in the chorio-allantoic fluid until hatching and were recovered from the intestine of the newly hatched chicks. *T. gallinarum* has been passed successively through embryos 23 times at one- to two-week intervals and apparently can be maintained in this manner indefinitely, although the chorio-allantoic fluid is not a favorable medium; only occasionally did the flagellates become numerous in it. By successive passage and selection of embryos in which the flagellates grew best, they were obtained bacteria-free and used in two series of cultivation experiments. In these, small numbers of organisms were added to liver-infusion-agar slants overlaid with turkey serum-saline, with and without single strains of certain bacteria. The flagellates failed to multiply in the medium alone or in medium plus *Escherichia coli* or *Aerobacter aerogenes,* whereas they became abundant in the presence of *Brucella suis, Pseudomonas fluorescens,* or *Bacillus subtilis.* They attained the highest counts and persisted longest, as a rule, in cultures with *B. suis.*

4. *Strains of* Trichomonas gallinae *Varying in Virulence.* ROBERT M. STABLER, Colorado College.

The varying reactions of similarly housed pigeons, from the asymptomatic carrier to the bird dying riddled with canker lesions, has led to speculation as to whether or not there exists more than one strain of *T. gallinae* with respect to virulence. To test this idea, the writer used the flagellates from the mouths of pigeons from 5 widely separated and unrelated sources. These 5 strains were put successively into the mouths of 5 series each of 5 exactly comparable pigeons. They were 6, 5½, 22, 28, and 36 weeks of age, respectively. The strains were numbered as I–V; the 5 series of birds as 1–5; and the extent of lesion recorded as 0 = no gross pathology, + = very slight oral caseation which healed in 2–4 days, ++ = moderate caseation lasting about 10 days, +++ = severe caseation remitting just short of death, and ++++ = extreme caseation terminating in death. The results were as follows: strain I gave ++, ++++, ++++, ++++, and ++++ respectively for the five runs; strain II gave 0, 0, 0, 0, and 0 lesions; strain III gave 0, +, 0, +, and + respectively; strain IV showed +++, +++, ++++, ++, and ++ lesions; while strain V gave ++++, +++, ++++, +++, and ++++. It appears, then that these strains of *T. gallinae* varied from one which produced no visible pathology (II), to one that actually killed 4 of the 5 birds into which it was put (I).

5. *Infection with a Less Virulent Strain of* Trichomonas gallinae *as a Protection Against a More Virulent One.* ROBERT M. STABLER, Colorado College.

Having established the variation in virulence among strains of *T. gallinae* it seemed worth determining whether or not infection with a milder strain would protect aganst the effects of a more virulent one. Accordingly, 8 pigeons 7 wks. old were inoculated *per os* with a strain (V) which always caused severe canker, and some deaths. In 3 days all showed marked lesions,

and 2 died on the 8th and 13th days, respectively. The remaining 6 recovered. They were each given a more severe strain (I) on the 54th day after the initial inoculation. This strain (I) had just killed 12 of 13 birds into which it had been put. None of these 6 birds developed the slightest gross lesion, and on autopsy at the 83rd day all were free of active pathology. Eight more birds, 7 at 8 wks. and one at 2 yrs. of age, were given a strain (III) that had never produced more than an occasional, short-lived caseation. Only one (at 13 days) showed a small, quickly-disappearing canker spot. At 27 days these were given the virulent strain (I). One bird showed a lesion at 5 days, was quite cankerous at 8, and had recovered by 13 days. A second showed a small, short-lived lesion at 13 days. No bird died. On autopsy 21 days after receiving strain I, the bird with the severe pathology at 8 days had considerable liver scarring; the other 7 showed nothing. It would seem that some protection against a very virulent strain of *T. gallinae* was acquired with recovery from an attack by a less virulent strain.

6. *Unisexual Infections with* Schistosomatium douthitti (*Trematoda*). Robert B. Short, University of Michigan.

Three white rats and eight laboratory-reared mice (*Peromyscus maniculatus*) were exposed to cercariae of *Schistosomatium douthitti* from two wild snails (*Lymnea palustris*)—one naturally, the other experimentally infected. At autopsy, 23–81 days after the first exposure, all hosts were positive and only female worms were recovered. These were sexually mature, for eggs were in uterus and in host tissues. In seven infections of 32 days duration or longer, some eggs in host tissues contained fully developed, living miracidia; a few hatched under coverglass pressure.

Later, 10 laboratory-reared *L. palustris,* each infected by a single miracidium derived from bisexual infections, were sources of cercariae for infection of laboratory-reared *P. maniculatus.* All mice herein considered harbored adult worms of one sex only. Only males developed from cercariae coming from five snails and females from the other five. Sexual maturity of males and females was attained in the absence of the other sex.

In this series, 22 mice were parasitized by females only; these contained eggs in uterus, and fully developed, active miracidia were found in eggs in the tissues of 16 mice infected for 29 days or more.

No spermatozoa were found in the seminal receptacles of 20 stained females from these unisexual infections (14 mounted whole, six serially sectioned) nor in 100 eggs in the six worms sectioned.

This appears to be the first report on the Schistosomatidae involving the full development of female worms and their ova in the absence of males.

7. *Penetration Glands in Cyclophyllidean Onchospheres.* W. Malcolm Reid, Monmouth College.

A pair of unicellular glands has been demonstrated in the onchospheres of the cestodes, *Raillietina cesticillus* (Molin) and *Choanotaenia infundibulum* (Bloch) from chickens, *Moniezia expansa* (Rudolphi) from sheep, and *Hymenolepis sp.* from herring gulls. These glands stretch from the posterior end of the embryo forward to pores at the anterior tip where the granular secretion sometimes exudes during larval movements. The uninucleate glands are connected by a narrow isthmus near the posterior end.

Functionally these glands appear to be correlated with the penetration process. The presence of this secretion near the area of hook activity suggests that it assists either by erosion of the cells in the area of invasion or by means of its adhesive properties in helping the hooks to obtain a better purchase on the host tissues. Although similar penetration glands have been recognized in trematode cercariae and miracidia, they have not been generally recognized in cestode larvae.

8. *Observations on Experimental Dermatitis in Humans Induced by Cercariae of* Trichobilharzia stagnicolae (*Talbot, 1936*). Louis Olivier, National Institute of Health.

Twenty-two individuals were exposed to cercariae of *Trichobilharzia stagnicolae,* one of the known dermatitis-producing cercariae. From 10 to 30 cercariae were applied to the skin of the forearm within a circular area approximately 18 millimeters in diameter. Evidence of penetration was obtained in each case. In all but 3 cases a distinct prickling sensation was experienced as the cercariae penetrated. In all cases macules were observed in the exposed area within a few hours after the cercariae were applied. The macules usually disappeared within a few hours after their appearance. Four of the 22 individuals had a history of schistosome dermatitis contracted naturally. In each of these 4 cases typical schistosome dermatitis developed after the cercariae were applied in this test. The other 18 individuals had no history of exposure to cercariae of *T. stagnicolae* or other dermatitis-producing cercariae. In none of these 18 cases did typical schistosome dermatitis develop. Three of the 18 had no lesions following the disappearance of the macules. Papules developed in the remaining 15 cases but these papules were

strikingly different from those described for typical schistosome dermatitis. They differed in that they were smaller, they appeared later, and there was no edema or diffuse erythema associated with them. Moreover, in only 2 of the cases was there any itching and in those it was mild and transitory. These results suggest that the clinical entity known as schistosome dermatitis does not develop when an individual is exposed to the cercariae of *T. stagnicolae* for the first time and further suggest that repeated exposure is necessary to produce typical schistosome dermatitis.

9. *Notes on the Life Cycle of* Schistocephalus *sp., a Tapeworm from Gulls.* LYELL J. THOMAS, University of Illinois.

Shed segments of tapeworms were observed on the lake bed in about seven feet of water forming a ring around Pismier Island, Lake Michigan, June 7, 1947. Some were collected and proved to be those of a *Schistocephalus* sp. Three ring-bill gulls from this same island examined on July 13 had a total of five of these tapeworms. The worms were placed in a refrigerator for later experimental use. Ellipsoidal, operculate, dark amber colored eggs measuring 45 $\mu \times 87\ \mu$ were teased from the segments and placed in shallow water in Petri dishes to incubate at room temperature on July 2, 1947. Hatching proceeded with great speed when the fully embryonated eggs were exposed to strong lamp light. The coracidia measured 113 $\mu \times 147\ \mu$ and swam vigorously, without a rolling motion for four or five days before water taken in by the embryophore caused ciliary action to cease. Coracidia when exposed to both *Diaptomus* and *Cyclops* developed in *Cyclops leuckarti* and in no other species of *Cyclops,* in about fifteen days. Twelve guppies were placed with infected crustaceans on August 9 and three days later two of them died but were negative for tapeworms. Another large female guppy from this lot was examined September 29 but contained no tapeworms. The experiment is being continued.

10. *The Sedimentation Rate of Erythrocytes in Malaria Infections and Its Correlation with the Electrophoretic Mobility.* W. B. REDMOND AND W. S. POLLITZER, Emory University.

The sedimentation rate of red blood cells has been determined for normal pigeons, and for pigeons infected with *Plasmodium relictum.* During the period of increase in number of parasites the sedimentation rate changes little. Following the peak of parasitemia when the parasites are being destroyed, the sedimentation rate as well as the total amount of sedimentation increases 2 to 5 fold. When normal cells are placed in infected plasma there is no increase in the sedimentation rate, but when cells from an infected bird are suspended in normal plasma the rate is increased 6 to 8 fold. The total amount of sedimentation likewise increases to the same extent. One factor which appears to be of primary importance in determining the sedimentation is the volume per cent of packed cells. A decrease in volume of packed cells results in an increase in the sedimentation rate.

Although an increase in the serum globulins of the infected birds is found to be correlated with the increased sedimentation rate the plasma from an infected bird has no effect on the rate of normal cells.

A reduction in the electrophoretic mobility accompanies the increase in number of parasites. Tests have indicated that the reduction of the charge on the cells may be an important factor in the reduction of the sedimentation rate.

11. *Coccidia of the Mink.* NORMAN D. LEVINE, University of Illinois.

Four species of coccidia encountered in a dead mink (*Mustela vison*) from an Illinois fur farm are described: (1) *Eimeria vison* (oöcysts ellipsoidal; mean oöcyst dimensions 22.8 by 15.4 $\mu$; mean length-width index 1.50; no oöcyst micropyle or residual body; large, coarsely granular sporocyst residual body); (2) *Eimeria mustelae* (oöcysts subspherical; mean oöcyst dimensions 16.1 by 14.4 $\mu$; mean length-width index 1.10; no oöcyst micropyle or residual body; sporocyst residual body represented by a few scattered granules); (3) *Isospora bigemina* (oöcyst wall very thin and stretched by sporocysts; mean oöcyst dimensions 12.4 by 9.0 $\mu$; mean length-width index 1.4; no oöcyst micropyle or residual body; large sporocyst residual body); and (4) *Isospora laidlawi* (oöcysts ellipsoidal; mean oöcyst dimensions 34.0 by 26.5 $\mu$; mean length-width index 1.26; no oöcyst micropyle or residual body; small sporocyst residual body). *E. mustelae* and *I. laidlawi* are reported from the mink for the first time.

12. *The Effect of Sulfaquinoxaline on the Developmental Stages of* Eimeria tenella. ASHTON C. CUCKLER AND WALTHER H. OTT, Merck Institute for Therapeutic Research, Rahway, N. J.

Delaplane et al (1947, North Am. Vet., **28**: 19–24) have found that sulfaquinoxaline (2-sulfanilamido quinoxaline) is highly effective for the control of cecal coccidiosis of the chicken. We are reporting studies on the mode of action of sulfaquinoxaline on the developmental stages of *Eimeria tenella.*

Equivalent groups of two-week-old chicks were placed on 0.1% drug diet one day before, concurrent with, or 1 to 7 days after, inoculation with 200,000 sporulated oöcysts. At 24-hour

intervals after being placed on the drug diet, two chicks from the treated groups and a control were killed and the ceca were examined for progress of infection and therapeutic action. The ceca were preserved in Bouin's solution, sectioned and stained for study. On the tenth day the ceca of surviving chicks were homogenized and examined for oöcysts.

This study indicates that sulfaquinoxaline has a lethal effect on some of the sporozoites or first generation schizonts; however, the development of these stages is not completely inhibited as the large second generation schizonts produce merozoites and their liberation is accompanied by hemorrhage. Microscopically the second generation merozoites appear degenerated. Third generation schizonts, gametocytes, and oöcysts do not develop when chicks are placed on 0.1% sulfaquinoxaline drug diet before the fourth post-infection day.

13. *Observations on* Leucocytozoon *Infections in Birds Receiving Paludrine, Atebrin, and Sulphamerazine.* A. Murray Fallis, Ontario Research Foundation, Toronto.

Paludrine, atebrin, and sulphamerazine were given to ducklings which were exposed to, or showing infection with *Leucocytozoon simondi.* Paludrine was given also to a crow showing a heavy infection of *L. sakharoffi.* The following dosages were used: One group of ducklings received 1 mg paludrine daily for 15 days following exposure; a second group received 1 mg paludrine t.i.d. for 4 days following appearance of infection in the blood; a third group received 2 mg atebrin daily for 15 days following exposure; a fourth group received 2 mg atebrin t.i.d. for 4 days following appearance of infection in the blood; a fifth group was given 50 mg sulphamerazine daily for 27 days following exposure. The drugs, in the dosages used, neither prevented nor cured infections with *L. simondi,* nor did they cause any obvious reduction in the number of parasites, and no morphological changes, which could be attributed to the drugs, were observed in the parasites. A crow which was heavily infected with *L. sakharoffi* was given 2 mg paludrine 4 times a day for 4 days but failed to recover. These results may be of interest in view of the action of these drugs on parasites of the related genus *Plasmodium.* The paludrine was kindly supplied by Imperial Chemical Industries.

14. *A New Ruling for the Ocular Disc of Special Usefulness in the Teaching of Medical Parasitology.* Edward P. Offutt, University of Rochester.

One of the greatest problems for the medical student in his consideration of parasitological specimens is to retain a concept of absolute size and of size relationships. To aid in this, and to facilitate the demonstration and study of specific points and areas, a new ruling for the ocular disc is suggested and a model demonstrated. Its features include: (1) a pointer; (2) an approximate ocular micrometer; (3) an indicator of red-blood-cell average size for the usual lenses of the student microscope; and, (4) a means for overlapping the field by a constant amount in a consistent manner, thereby permitting much easier systematic examination of entire preparations or specimens.

An opportunity will be given to express an interest in having this ruling made available on a commercial scale.

15. *The Metabolism of Mammalian Trypanosomes and Their Classification.* Theodor von Brand and Eleanor Johnson Tobie, National Institute of Health.

Hoare and Coutelen (1933) have divided the mammalian trypanosomes into Group A (*lewisi* group including *T. lewisi, T. theileri, T. melophagium,* and *T. cruzi*) and Group B with the subgroups *evansi* (*T. evansi, T. equinum,* and *T. equiperdum*), *vivax* (*T. vivax, T. caprae* and *T. uniforme*), *congolense* (*T. congolense* and *T. simiae*), and *brucei* (*T. brucei, T. rhodesiense,* and *T. gambiense*). This grouping which was based solely on morphological and developmental grounds, has apparently also a physiological basis. The members of Group A (*T. lewisi, T. conorhini,* and *T. cruzi*) have a cyanide-sensitive respiration and a relatively low rate of sugar consumption. All members of the *evansi* (*T. evansi, T. equinum,* and *T. equiperdum*), *congolense* (*T. congolense*), and *brucei* (*T. brucei, T. rhodesiense,* and *T. gambiense*) subgroups so far studied have a very high rate of sugar consumption. The respiration of the *evansi* and *brucei* subgroups is not inhibited by cyanide, that of the *congolense* subgroup is moderately cyanide-sensitive. No member of the *vivax* subgroup has so far been studied.

16. *Studies on Experimental Blackhead Infection in Turkeys.* Francis McKay and Neal F. Morehouse, Dr. Salsbury's Laboratories, Charles City, Iowa.

The use of embryonated ova of the cecal worm *Heterakis gallinae* for the transmission of the blackhead organism, *Histomonas meleagridis,* to turkeys, as reported by Graybill and Smith (1920), Tyzzer and Fabyan (1920) and Tyzzer (1934), has not been generally adopted by investigators working with this disease. In a series of 54 experiments involving 313 unmedicated turkey poults receiving embryonated *Heterakis gallinae* ova, 251 (80%) of them died of blackhead disease. A mortality of 100% was obtained in 24 of these experiments containing 113 poults, and at least 75% mortality was obtained in 43 of the 54 experiments. The *Heterakis*

*gallinae* ova used in these experiments were from cecal worms of chickens obtained from local dressing plants. Clinical symptoms of blackhead appeared as early as the 10th day after infection and as late as the 20th day after infection, most poults developing symptoms on the 12th to the 14th day. Mortality was greatest during the 15th to the 20th day after infection with deaths occurring as early as the 13th and as late as the 29th day.

17. *The Taxonomic Value of the Gnathasome in Certain Laelaptine Mites.* R. W. STRANDTMANN, University of Texas.

The difficulty frequently encountered by systematists in trying to place mites in their proper categories makes it imperative that all possible characters be examined for possible taxonomic values. The chelicerae, palpi, hypostome, epistome and also the tritosternum have long been recognized as of value in placing mites in the larger categories. In certain Laelaptine mites, however, these structures show variations which are of value on the genus and even species levels.

18. *The Resistance of Certain Adult Ducks to Infection by the Avian Malaria Parasite* Plasmodium lophurae. WILLIAM TRAGER, Rockefeller Institute for Medical Research.

White Pekin ducks 5 to 7 months old were inoculated intravenously with heparinized blood from young ducklings heavily infected with *P. lophurae*. The dosage was approximately one billion parasites per kilogram of body weight and the parasite count immediately after inoculation, was 50 to 200 parasites per 10,000 red blood cells. In most of the female ducks with active ovaries at the time of infection, as evidenced by actual egg production or by the finding of developing yolks at autopsy, the parasites underwent relatively little or no multiplication. All the females with inactive ovaries developed heavy infections, as did most of the males. The average free biotin and bound biotin-active lipoid material of the plasma before inoculation were highest in the egg-laying females, lowest in the males and intermediate in the females with inactive ovaries. In a few of the resistant individuals abnormal forms of the parasite appeared within a few days after inoculation and persisted for several weeks in small numbers.

19. *Immunity in Avian Malaria in Relation to Severity of Infection.* WENDELL GINGRICH, University of Texas.

In the course of testing drugs with *Plasmodium cathemerium* in canaries it has been observed frequently that infection is markedly suppressed but not cured, with no recrudescence or relapse following discontinuation of treatment. To test the immunity of animals with this type of infection 10 birds with very scant parasitemias (less than 1 to 18 parasites per 10,000 rbc) were superinfected with 10 million parasites after blood examination had become negative. Three showed no evidence of immunity, one doubtful, and 6 had about the same degree of immunity as birds which had recovered from typical acute infections.

20. *Progress Report on the Parasitic Stages of* Chabertia ovina. W. L. THRELKELD, Virginia Agricultural Experiment Station.

Parasite-free lambs, administered orally the infective larvae of *Chabertia ovina*, were necropsied on dates varying in length from the date of oral administration.

At 90 hours the third-stage larvae have undergone ecdysis and are either attached to the mucosa of the wall of the upper colon or have entered the wall. Petechial hemorrhages were profuse in the region and sections obtained therefrom revealed larvae attached to and embedded in the mucosa. The larvae measure 650 μ and the head region is characterized by lateral vacuolations. At 96 hours little change in larvae other than a slight thickening and a somewhat enlarged head region is discernible. At 6 days larvae average 1040 μ in length and a provisional buccal capsule is being formed. No sheaths could be determined. At 13 days the larvae measure 1300 μ in length the provisional buccal capsule is complete but no sheath could be determined and no sex differentiation is apparent. On the 18th day the male and female larvae are approximately the same length averaging slightly over 2 mm in length. Sex differentiation is evident and the permanent buccal capsule is being formed. The larvae are sheathed. This stage represents the later development of the 4th stage larvae as on the 25th day, ecdysis has taken place, the permanent buccal capsule is formed, but only one row of circum-oral teeth are present. The dorsal gutter has not yet split to form the sub-oral canal. On the 34th day the male and female are approximately the same length, averaging 7 mm, the sex organs being well developed. At 38 days copulation takes place and from 48 to 54 days adult worms are present and eggs appear in the feces.

21. *What Is a Virgula in Virgulate Cercariae?* FRANCIS J. KRUIDENIER, University of Michigan.

The virgula is a bilobed or paired organ with undetermined functions, in or near the oral sucker of certain species of xiphidiocercariae. In late larval and emerged cercariae, virgulae

are primarily paired structures, secondarily fused in some species, the reservoirs for secretions from paired unicellular glands arising antero-laterad to the acetabulum in close association with penetration glands. These paired pre-virgula glands empty through individual ducts into a forcibly enlarged weak oral sucker while still in the rediae. This secretion is readily hydrolized by inorganic acids or weak bases; a precipitate caused by acetic acid is hydrolizable by inorganic acids. These reactions often indicate mucin compounds. Thionin, toluidin blue, and methylen blue demonstrated histochemically differential metachromatic mucin reactions of the virgula and glands as did neutral red, muchaematin, mucicarmine, and methyl green. Observations of emerged living and mounted specimens indicate that mucin discharged from the virgula supplements the weak oral sucker as a means of attachment. Published reports indicate further use during penetration into the host or during metàcercarial development.

Paired glands parallel to those discussed above and others postero-lateral to the acetabulum discharge ventrally before the cercariae rupture the embryophore, enveloping them in a thin mucous sheath which is largely dissipated before cercariae emerge from snail hosts. Homologous glands and dispersed analogous cells are described in non-virgulate cercariae in abstract. . . . Apparently their mucous sheath aids and protects cercariae during their migrations through snail hosts.

22. *Quantitative Hookworm Diagnosis by Direct Smear.* Paul C. Beaver, Tulane University.

The direct fecal smear can be standardized by using a photoelectric type of light meter to measure its density (turbidity). Statistical analysis of multiple egg-count data indicates that eggs of the hookworm, *Necator americanus,* have random distribution in the fecal mass, and that on individual stools egg counts by the *standard direct smear* (*s.d.s.*) do not vary more than counts made by the Stoll dilution method. Close positive correlation exists between s.d.s. counts and dilution counts, the correlation being generally much closer when the latter are corrected to the formed stool basis. Day-to-day egg counts on the same individual are less variable by s.d.s. than by the dilution method. Counts by s.d.s. can be readily interpreted in terms of eggs per cc of formed stool or in terms of worm burden.

23. *A Method for Testing the Effect of Substances upon the Activity of the Larger Nematodes.* K. B. Kerr and J. W. Cavett, Dr. Salsbury's Laboratories, Charles City, Iowa.

A procedure for the purpose of determining the effect of substances on the muscular activity of the larger nematodes is described. *Ascaridia galli,* has been used throughout this work. The worm is suspended in physiological saline at 40° C in a manner permitting a recording of its movements on a smoked drum. The saline is then removed, the test solution substituted, and its effect on the movements of the worm is recorded. The physical effect of changing solutions does not affect the worm, but care should be taken to have test solutions at approximately the same pH and temperature as the saline solution.

The effect of a number of known anthelmintics has been studied by this method and it has been found that these compounds cause a shortening of the nematode and a cessation of the normal irregular contractions demonstrated in the saline. Even after a considerable period of time there is seldom a recurrence of contractions, only a gradual relaxation of the worm. Upon removal from the apparatus the worms are usually still alive, for the release of tension permits them to curl and uncurl slowly. Substances which are not anthelmintics have no effect.

It is believed that this procedure provides a rapid and reasonably accurate method of determining whether a substance may have sufficient effect on the nematode to warrant an *in vivo* test for the anthelmintic effect of the substance.

24. *Immunity in Chickens to* Ascaridia galli. Elvio H. Sadun, Johns Hopkins University.

In studies on resistance to *Ascaridia galli,* several groups of chickens have been experimentally infected with doses varying from 100 to 35,000 eggs. Out of 36 previously infected chickens, 30 eliminated all worms of the test dose while all controls, except one, harbored from 6 to 92 worms each. This acquired resistance persisted for over two months.

Sera from heavily infected chickens, tested *in vitro* with *Ascaridia* larvae, caused precipitates to be formed particularly around the mouth, thus indicating the presence of antibodies. No such precipitates were formed in normal sera. By serial dilutions it was possible to determine the titer of the antibodies responsible for the precipitates. Chickens which received repeated infections had a higher antibody titer than chickens with a single heavy infection. Older animals with an infection of 3,000 eggs, produced a higher antibody response than younger birds after receiving 12,000 eggs.

Intraperitoneal injection into 6-week-old chickens of serum from hyperimmune birds, elicited manifestations essentially the same as those seen in active immunity, showing that antibodies present in the serum are protective in nature and can be passively transferred. When very large

numbers of eggs were given to 3-day-old chickens, 100 per cent of those which received hyperimmune serum survived, while less than 50 per cent of those receiving normal serum or no serum at all, lived.

The various results indicate that natural age resistance and acquired immunity in chickens to *Ascaridia galli* are, partly at least, serological in nature.

25. *Factors in the Resistance of White Rats to Infection with the Cotton Rat Filariids.* J. Allen Scott, University of Texas.

By infecting white rats and cotton rats under parallel conditions certain factors explaining the relative insusceptibility of white rats have been identified. The number of worms recovered is less from white rats than from parallel cotton rats at early stages of development. The rate of growth is slower in white rats than in cotton rats. In the white rats more of the growing worms die before reaching maturity or are immobilized by a tissue reaction. One observation of apparent importance is that the tissue reaction not only involves dead worms, but it is often initiated by a covering of host cells surrounding portions of live worms which are active and unattached.

26. *Comparative Filaricidal Activity of Trivalent Arsenic and Antimony.* G. F. Otto and T. H. Maren, Johns Hopkins University.

A number of amide substituted phenyl arsenoxides have been shown to have a marked lethal effect upon the adults of *Litomosoides carinii in vivo;* those which were further tested against the adults of *Dirofilaria immitis* were lethal to these organisms as well. The effects upon microfilaria are less clear. *In vitro* not only the amide substituted but other phenyl arsenoxides as well have an immediate lethal effect upon the *D. immitis* at much greater dilution than do any of the antimony compounds studied; however, *in vivo,* these have little or no demonstrable direct effect upon these microfilaria at several times doses required to kill the adult worms. On the other hand, while the *in vitro* activity of the several compounds against the microfilaria of *D. immitis* and *L. carinii* seems to be parallel, yet higher concentrations seemed to be needed to kill the latter. Conversely, however, the latter seem to respond more readily than the former *in vivo* while nevertheless being more resistant than the adults of either. It was not possible to study the *in vitro* action of these compounds upon the microfilaria of *Wuchereria bancrofti* but *in vivo* they are quickly killed by the same doses which have no demonstrable effect upon the microfilaria of *D. immitis* and *L. carinii.*

The trivalent antimonials, however, will kill microfilaria of all three species *in vitro* only at much greater concentrations than any of the trivalent arsenicals; furthermore, in our studies antimony killed these microfilaria much more slowly than did the arsenicals. Nevertheless, *in vivo* the trivalent antimony kills the microfilaria and injures the reproductive organs of the adult females without any appreciable number of the latter being killed; the injury to the reproductive tract is not immediately repaired if indeed it is not irreparable.

27. *Resumption of the Reproductive Phase of* Trypanosoma lewisi *in Recovered and Near Recovered Rats Following Both Reinoculation with the Parasite and Treatment with Sodium Salicylate.* Elery R. Becker and Michael G. Lysenko, Iowa State College.

It has already been reported that the immunizing process which brings about the disappearance of the dividing forms of *Trypanosoma lewisi* from the blood is inhibited by sodium salicylate treatment. It did not succeed, however, to reinitiate the reproductive phase of the infection by such treatment of rats from adult trypanosomes surviving in the blood, or of recovered rats reinoculated with adult trypanosomes. In further experiments a certain number of such rats, i.e., either harboring adult trypanosomes or recovered, were subjected to salicylate treatment and reinoculated with 4-day trypanosomes, but infection did not follow. When, however, the donor rats as well as the acceptor rats were treated, infections characterized by the reproductive phase were re-established in a certain number of such rats. The reproductive phase persisted until drug-treatment was discontinued. In due time the flagellates transformed to the normal adult types which survived for a period, and finally disappeared from the blood.

28. *An Effective New Coccidiostatic.* Paul D. Harwood, Dorothy I. Stunz, and Robert Wolfgang, Dr. Hess and Clark, Inc., Ashland, Ohio.

Furacin, which is manufactured by Eaton Laboratories, is chemically 5-nitro furfural semicarbizone. Since the manufacturers have demonstrated its bacteriostatic and bacteriocidal properties, it seemed advisable to test the compound against avian coccidiosis. 132 chicks, hatched July 6, 1947, were divided equally between 6 cages. One cage was kept as uninfected controls, but all the remaining chicks received by mouth 50,000 sporulated oöcysts of *Eimeria tenella* on July 24. Treatments were as follows: Cage 1, 0.011 per cent Furacin in the feed commencing July 22; cage 2, 0.011 per cent Furacin commencing July 26; cage 3, 0.017 per cent Furacin commencing July 26; cage 4, 0.017 per cent Furacin commencing July 27; cage 5, infected

controls; and cage 6, uninfected controls. The number of deaths occurring in each cage between July 24 and August 4 were as follows: Cage 1, 0; cage 2, 0; cage 3, 0; cage 4, 9; cage 5, 16; and cage 6, 0. When cages 4 and 5 are compared statistically, the value of chi-square is 4.78, which is well beyond the 5 per cent level. On August 9, all surviving chickens were given 200,000 sporulated oöcysts apiece. 5 birds from cage 6 died within the next two weeks. Throughout this experiment all birds which died were examined at necropsy, and all exhibited typical lesions of cecal coccidiosis. At these dosage levels, Furacin seems to be well tolerated, but at 0.1 per cent of the drug in the feed, chickens lose weight rapidly.

29. *A Method for Screening Anti-malarial Drugs in the Mosquito Host.* Levon A. Terzian, Naval Medical Research Institute.

With a drug-diet method devised for the administration of various concentrations of anti-malarial drugs, it has been possible to drug mosquitoes infected with *Plasmodium gallinaceum* and to test the effects of these drugs on the sporogonous cycle of the parasite. It has been found that quinine, quinacrine and 7-chloro-4-(4-diethyl amino-1-methyl butyl amino)-3-methyl quinoline bisulfate (SN 6911) administered in maximum tolerated doses to infected mosquitoes has no effect on sporozoite production or sporozoite viability, and sporozoites from mosquitoes treated with these drugs, inoculated into normal chicks produce infections indistinguishable from infections produced by the inoculation of sporozoites from control mosquitoes maintained on sugar nutrient solutions alone. On the other hand, in infected mosquitoes treated with adequate drug concentrations of sodium sulfadiazine oöcysts fail to develop properly and sporozoites are produced only rarely, and those that are produced appear to be incapable of producing infection when inoculated into normal chicks. In each case inoculation of whole mosquitoes or several mosquito equivalents has failed to produce infection. Below a certain critical concentration of the drug, however, sporozoite production and viability are not affected and sporozoites from mosquitoes treated with lower drug concentrations produce characteristic infections. From the known drug effects of sodium sulfadiazine and the other drugs cited it would appear, therefore, that there is a definite relation between drug activity and effect in the sporozoite infected vertebrate host and drug activity in the infected invertebrate host. This method may offer further promise as another means for studies on parasite metabolism or for studies on the mechanisms of drug action.

30. *Observations on Oribatid Mites, Vectors of* Moniezia expansa *on Pastures, with a Report of Several New Vectors from the U. S.* K. C. Kates and C. E. Runkel, U. S. Bureau of Animal Industry.

Collections of oribatid mites, concerned in transmission of *Moniezia expansa,* were made from (a) a large permanent sheep pasture at Beltsville, Md., (b) an irrigated pasture at Newell, South Dakota, and (c) a small pasture plot at Beltsville, Md., known to contain several species of oribatid mites, and "seeded" the previous year with *Moniezia* eggs in droppings. From these collections 6 species of oribatid mites, representing 5 genera and 4 families, contained cysticercoids of *M. expansa.* Only one of these species, *Galumna emarginatum,* is a known vector in the U. S. Another species, *Scheloribates laevigatus,* has been reported as a vector of moniezias and certain other anoplocephaline cestodes in Europe and Russia. Collections from pasture "(a)" revealed only one species, *Galumna virginiensis,* that contained cysticercoids; 34,224 mites examined, 3.9 per cent infected, 2,439 cysticercoids recovered. It is estimated that pasture "(a)" harbored in the top inch of turf a minimum of 6,000,000 *G. virginiensis,* containing more than 400,000 cysticercoids, per acre. *S. laevigatus* was the only infected mite from pasture "(b)"; 1,456 mites examined, 2.8 per cent infected, 64 cysticercoids recovered. Cysticercoids were found in 5 species of mites from "seeded" pasture plot "(c)"; *G. virginiensis,* 4,017 examined, 34 per cent infected, 3,873 cysticercoids recovered; *G. emarginatum,* 1,892 examined, 11 per cent infected, 378 cysticercoids recovered; *Oribatula minutus, Peloribates curtipilus* and *Protoschelobates seghettii* (data combined), 866 examined, 6 per cent infected, 87 cysticercoids recovered. The largest number of cysticercoids obtained from one mite, a specimen of *G. virginiensis,* was 13.

31. *The Relationship between Trombiculid and Trombidiid Mites.* G. W. Wharton, Duke University.

Until 1928 trombiculid mites were included in the family Trombidiidae. The trombiculids and trombidiids are similar in structure and habits. Both have larval stages that are parasitic and post-larval instars that are exclusively free-living. Trombiculids parasitize vertebrates; trombidiids parasitize invertebrates, usually insects. Collections of adults and the presumed larvae of a species of *Neotrombidium* in the Duke Forest has thrown some light on the relationships between the two families. The adults of *Neotrombidium* have recently been grouped with the trombiculids. The larvae of *Neotrombidium* have not been previously recognized. However they have been described under the generic name *Monunguis* and properly placed with the trombidiids

although they are morphologically similar to trombiculid larvae. It is possible therefore that the genus *Neotrombidium* represents a stage somewhat intermediate between the trombidiid and trombiculid mites. *Neotrombidium* can best be grouped with the trombidiids. The trombiculids most closely related to it are the members of the Leeuwenhoekiinae. If the Leeuwenhoekiinae represents the most primitive subfamily of the trombiculids, the trombiculinids and apoloninids must have arisen independently from them. The fourth subfamily, the Walchiinae, appears to have its origin from the Trombiculinae.

32. *Extended Persistence of Oöcysts of* Plasmodium relictum *in Culture.* Gordon H. Ball, University of California at Los Angeles.

Ball (1946, 1947) reported the persistence *in vitro* of oöcysts of *P. relictum* for six days on stomachs of *Culex tarsalis* cultured in hanging drops or in Carrel flasks. Failure of cultures to persist beyond this time was due in part to inability to maintain adequate nutritive and respiratory conditions with relatively small volumes of fluid. The successful culture of the erythrocyte stages of *P. knowlesi* by McKee, Ormsbee, Anfinsen, Geiman, and E. G. Ball (1946) with large volumes of fluid and with a continuous and controlled flow of gas offered a new method of attack. Infected mosquito stomachs were cultured on a cellophane membrane in a perfusion vessel, type 1. With this type of apparatus, apparently normal oöcysts of *P. relictum* could be demonstrated up to twenty-one days in culture. Despite better results in maintaining the oöcysts *in vitro,* there was little or no development of the oöcyst toward maturity.

33. *The Infectivity of Native Malarias in South Carolina to* Anopheles quadrimaculatus. Martin D. Young, Newton F. Hardman, Robert W. Burgess, William C. Frohne, and Curtis W. Sabrosky, U. S. Public Health Service.

In a field study in South Carolina, *Anopheles quadrimaculatus* mosquitoes were applied to native cases of malaria in Negroes to determine the infectivity of such malaria cases.

Of 142 feedings upon *Plasmodium falciparum* patients, 21 showed infections. Of 12,606 mosquitoes dissected, 2.5 per cent were infected. These infections developed normally in the mosquito, and in one out of two trials transmission was successful.

The majority of the mosquito infections occurred during the months of October through January. Mosquitoes kept at outside temperatures during October and November became infected.

One patient remained infective to mosquitoes over an eight-month period.

Of the 25 patients showing gametocytes, 60 per cent infected mosquitoes. The gametocyte densities resulting in infections were relatively low, none being over 90 per cmm. Thirteen of the infections resulted when the gametocytes were fewer than 10 per cmm.

Patients with asymptomatic parasitemias infected mosquitoes at about the same rate as those who were symptomatic. As the asymptomatic group is considerably larger than the other, it is concluded that this group is mainly responsible for the transmission of malaria.

There were 14 feedings upon *P. malariae.* Four cases showed gametocytes of a low density at feeding, and three lots of mosquitoes were infected. Of 586 mosquitoes dissected, 1.7 per cent were infected.

Of nine feedings upon *P. vivax,* none became infected, nor were gametocytes present.

It is concluded that the patient with an asymptomatic parasitemia, usually with a relatively low gametocyte density, is the important factor in the transmission and maintenance of *P. falciparum* and *P. malariae* malaria in the area studied.

34. *Expanding Horizons in the Recognition of a Phylum.* Harley J. Van Cleave, University of Illinois.

Presidential Address.

35. *The Trematode Genus* Tamerlania *in Resident Birds of the United States.* Elon E. Byrd, University of Georgia.

During the past summer (1947) a large number of bird species from the regions about Highlands, North Carolina, and Mountain Lake, Virginia, were examined for internal parasites. Three of the species examined harbored flukes belonging to the genus *Tamerlania* Skrjabin, 1924, in the ureter. At Highlands, flukes of the genus were found in the Red-eyed Towhee, *Pipilo erythrophthalmus erythrophthalmus,* and the Parula Warbler, *Compsothlypis americana;* while the Red-eyed Towhee, *P. e. erythrophthalmus,* and the Oven-bird, *Seiurus aurocapillus,* from the region about Mountain Lake were parasitized by flukes of the genus. In so far as has been determined members of the genus *Tamerlania* have not been recorded from any of these three species of birds, nor has the genus been recorded previously from a species of bird known to be a permanent resident of the Continental United States. The presence of the genus in the Towhee constitutes such a new record. The only other record of the genus *Tamerlania* from a bird in the United States was reported by Penner (1939, J. Parasitol. **25**: 421) from the migratory

Lincoln's Sparrow (Minnesota). Previously the genus has been recorded from various birds from Europe, Asia, Japan, Brazil, and Puerto Rico.

36. *Mucin in Developing Digenetic Trematodes.* Francis J. Kruidenier, University of Michigan.

Anterior and posterior paired glands of virgulate cercariae (abstract 21) have homologues in widely different cercariae giving identical histochemical reactions. In some species structural adaptations conserve mucous secretions.

In developing microcercous cercariae of *Paragonimus kellicotti* (Troglotrematidae) paired large anterior and posterior unicellular glands discharge mucus through individual ducts that empty respectively into an adherent antero-dorsal mass and a post-acetabular ventral groove. From the latter is discharged a mucus thread that anchors emerged cercariae to substrates. Analogous small cells provide emerging cercariae with mucinous envelopes. Cercariae of *Sellacotyle mustelae* (Troglotrematidae) contain homologues.

A deep caudal pocket in cercariae of *Macroderoides typicus* (Macroderoididae) and paired, sub-terminal, bilateral pits in other cercariae of the Armatae and Ornatae groups open through channels dorsal to the tail base and act as reservoirs for paired posterior unicellular mucin glands that discharge before cercariae leave their rediae. Paired cells parallel penetration glands in position, development, and ducts and provide mucin for emerging cercariae.

Certain pleurolophocercous cercariae (*Euryhelmis monorchis* and undetermined species) demonstrate paired anterior and posterior mucin glands during development but emerged cercariae retain no mucin reservoirs. Furocercous cercariae of *Clinostomum marginatum* have one pair of glands anterior to the eye spots with ducts paralleling those of penetration glands, and numerous mucin glands along the dorso-lateral surface. Certain glands discharge for use during emergence; five pairs are retained by emerged cercariae.

Wide occurrence in developing digenetic trematodes indicates that mucin must have considerable significance.

37. *Some Effects of Acanthocephala on the Large-Mouthed Black Bass.* Carl E. Venard and John H. Warfel, The Ohio State University and Western Reserve University.

In addition to other observations on the effects of *Leptorhynchoides thecatus* (Linton, 1891) and *Neoechinorhynchus cylindratus* (Van Cleave, 1913) on *Huro salmonides* (Lacépède), parasitized portions of alimentary canals were sectioned. Tissue damage due to the action of the spiny proboscis is evident in all of the material. There is mechanical destruction of much mucosa and submucosa. In one series of sections, where the hooks are deeply embedded in muscle tissue, the cells are cut as though by a sharp knife. The submucosa has many tunnels, often filled with cellular debris, and it is infiltrated with lymphocytes and many erythrocytes are present. Large masses of nuclei located around the parasites, or where the parasites had been, are evidence of the destruction of numerous cells. Aggregations of bacteria are present in some of the lesions.

38. *A Method for Relaxing and Fixing Large Cestodes.* Robert L. Roudabush, Ward's Natural Science Establishment, Inc., Rochester, N. Y.

Tape worms, the size of *Taenia saginata,* are relaxed in water in an ice box over night. Specimens so relaxed are stretched to normal size by winding them on a beaker and fixed while still on the beaker thus avoiding contracted, distorted specimens. The formula for the fixing solution is 95% Ethyl Alcohol, 24 parts; Formalin, 15 parts; Glacial Acetic Acid, 5 parts; Glycerine, 10 parts; Tap Water, 46 parts.

39. *Mammalian Blood Flukes of Celebes.* Ernest Carroll Faust, Tulane University, New Orleans, Louisiana, and C. Bonne, Universiteit van Indonesië, Batavia, Java.

*Schistosoma japonicum* was first found to be indigenous to the Lake Lindoë region of Celebes by Müller and Tesch (1937), who discovered human infection. The worm was later recovered from man, dog and deer from this area (Bonne et al, 1942). The molluscan host is thus far undiscovered. Fork-tailed cercariae, obtained from a species of *Lymnaea* in the vicinity of Lake Poso, were used experimentally in attempted infection of white rats and mice. On sacrifice the rats were negative but portal blood of the mice contained somewhat immature flukes. Study of the cercariae and adolescent worms indicates that they are not *S. japonicum* and possibly may belong to a different genus of Schistosomatidae.

40. *Germinal Masses in the Rediae of the Trematode Order Fasciolatoidea Szidat, 1936.* W. W. Cort, Johns Hopkins University, D. J. Ameel, Kansas State College, and Anne Van der Woude, University of Michigan.

The germinal material was studied in rediae of species of Paramphistomidae, Notocotylidae, Psilostomidae and Echinostomidae. In an amphistome, *Allassostoma parvum,* Stunkard, 1916,

and a notocotylid, *Quinqueserialis quinqueserialis* (Barker and Laughlin, 1911), very immature daughter rediae had at the posterior end of the body cavity simple morula-like germinal masses consisting of unicellular components. Evidence from the study of older rediae indicated that these simple germinal masses were gradually used up by the formation of embryos from their components.

Studies were also made of the germinal material in the rediae of a psilostome, *Psilostomum ondatrae* Price, 1931, and of certain echinostome species, *Echinostoma revolutum* (Froelich, 1802), *Petasiger nitidus* Linton, 1928 and at least two that were unidentified. In the very youngest daughter rediae the germinal masses also had only unicellular components. But in older rediae, both mother and daughter, larger germinal masses were present with both unicellular and multicellular components. These were frequently attached at one side of the wall of the posterior end of the body cavity, and were still present in the very oldest rediae examined. They resemble in structure the floating germinal masses of the daughter sporocysts of the plagiorchiids.

Perhaps the simpler germinal masses in the amphistome and notocotylid rediae represent a more primitive condition associated with a rather limited production of individuals, while the large persistent germinal masses of the psilostome and the echinostome rediae are an adaptation for greater embryo production over a longer period of time.

41. *Germinal Material in Mother Sporocysts and Rediae of* Halipegus eccentricus *Thomas, 1939.* D. J. Ameel, Kansas State College, W. W. Cort, Johns Hopkins University, and Anne Van der Woude, University of Michigan.

*Halipegus eccentricus,* a hemiurid trematode from the eustachian tubes of the frog, has its mother sporocyst and one generation of rediae in species of *Physa* in the Douglas Lake region, Michigan. A very unusual development of germinal masses was observed in a large series of immature stages of mother sporocysts and rediae from both experimental and natural infections. A morula-like germinal mass consisting only of unicellular components is present in the miracidium and youngest mother sporocyst. In a stage 0.1 mm in length, the body cavity is almost completely filled with germinal masses composed of both unicellular and multicellular components. In later stages these produce large numbers of embryos, and in almost mature mother sporocysts all the germinal masses have broken down into embryos except one attached near the posterior end. This was still present in the oldest mother sporocyst seen. It is estimated that by this germinal mechanism in the mother sporocyst 200 or more redial embryos can be produced. In very immature redial embryos a morula-like germinal mass of unicellular components is present near the posterior end. In older embryos germinal masses are found all along the body cavity. In later stages these break up into cercarial embryos, leaving finally a single large germinal mass in the posterior end which is still present and giving off embryos in mature rediae. This mechanism provides for the production of the large numbers of cercarial embryos that are present in the large mature rediae of this species.

42. Porocephalus crotali *Humbolt (Pentastomida) in Oklahoma.* J. Teague Self, University of Oklahoma.

Rattlesnakes examined from Oklahoma show an over-all eight per cent infection of the pentastomid *Porocephalus crotali* Humbolt. Heaviest infections occur in specimens isolated in the areas of hibernation caves in the Wichita Mountains Wildlife Refuge. As many as 158 specimens have been collected from the lung of one individual.

Specimens show size relationship with the three species of the genus, *P. crotali, P. clavatus* and *P. stilesi,* and differ from previous generic designations in the absence of auxiliary hooks and the sameness of lateral and median hooks. Further study may require a revision of the generic description or the establishment of a new genus.

The deermouse, *Peromyscus leucopeus aridulus* Osgood, serves as the principal secondary host, particularly around hibernation caves.

43. *Additional Infection Experiments with the Hookworm,* Bunostomum phlebotomum, *in the Calf.* Roy L. Mayhew, Louisiana State University.

The following experiments are a continuation of those reported by the writer in the Journal of Parasitology 2: 14 Supplement. Five additional calves have been inoculated by placing infective hookworm larvae on the skin. Eggs were recovered from the manure of four of the animals between the 52nd and the 62nd day after inoculation. No eggs were recovered from the fifth even though he showed the most severe symptoms. Three animals had periods of diarrhea on the following days after inoculation—from the 16th to 26th, 28th to 62nd, and from the 37th to the 53rd. Weights were taken over a period of 125 days following inoculation. An examination of the weights showed that four animals had more or less irregularity in their gains during the period between 29 and 60 days following inoculation. During the two months following the end of the pre-patent period all animals made regular gains in weight. One un-

inoculated animal kept under the same conditions of management made regular gains during the entire experiment. One calf died on the 53rd day after a period of diarrhea lasting 17 days and a loss of 58 pounds.

These data suggest the following conclusions: (1) That the hookworm of cattle is the cause of severe symptoms and considerable economic loss to the cattlemen, (2) that infection takes place through the skin thus making barn and shade sanitation a necessary part of the management program, (3) that the symptoms of infection are developed during the pre-patent period, and (4) that a general improvement in condition follows during the adult life of the parasite.

These observations strongly suggest that treatment is of little value during the period of acute symptoms but should, however, be utilized in the program of control to eliminate the egg-producing adults and thus reduce the number of larvae about the premises which may serve as a cause of further infections.

44. *On Certain Pseudophyllidean Cestodes from Alaskan Pinnipeds.* Horace W. Stunkard, New York University.

Tapeworms from the bearded seal, *Phoca barbata,* the fur seal, *Callorhinus ursinus,* and the sea lion, *Eumetopias jubata,* have been studied. There are 3 and perhaps 4 species represented. The worms from *P. barbata* are monogonadic; those from *C. ursinus* represent 2 species, one monogonadic, the other diplogonadic; while those from *E. jubata* are similar to and possibly identical with the diplogonadic form from *C. ursinus.* The observed differences may be the result of development in different hosts. Similar and probably in part identical tapeworms from the bearded and fur seals were reported by Wardle, McLeod, and Stewart (1947, J. Parasitol. 33: 319–330). The worms were regarded as congeneric and a new genus, *Cordicephalus,* with *Taenia phocarum* Fabricius, 1780 as genotype, was erected to contain them. All diphyllobothrid cestodes from members of Phocidae in North Atlantic waters were assigned to a single species, *C. phocarus* (Fabricius, 1780) and those from members of the Otariidae to *C. arctocephalinus* (Johnston, 1937). It should be noted that *T. phocarum* Fabricius, 1780 was designated as type of a new genus, *Pyramicocephalus* by Monticelli, 1890; consequently *Cordicephalus* is a synonym of *Pyramicocephalus.* Although the allocation of species by Wardle et al is not acceptable, specific determination of the specimens at hand must be tentative until the morphology and taxonomic status of previously described species are clarified.

45. *Nature of Duodenal Nematode Growth-Inhibiting Factor.* Lyman P. Frick and J. E. Ackert, Kansas State College.

In studies interrupted by World War II, it was demonstrated that duodenal mucus of growing chickens contains a nematode-growth-inhibiting factor. *Ascaridia galli* removed from fowls and placed in a nutrient solution grow in length. When duodenal mucus from resistant chickens is placed in the nutrient worm culture the worms' growth is retarded, sometimes to the extent of losing length. It was to determine if such effects on the worms are permanent that the studies here reported were made.

Three groups of *A. galli* subjected to the action of the mucus for a week, were remeasured and transferred to the regular nutrient solution. The worms in two of the three groups, after losing length in the mucus cultures, had the ability to recover and resume growth when they were transferred to the nutrient solution. In the next test with three groups of *A. galli,* all of the worms lost length in the mucus culture and resumed growth when they were returned to the nutrient solution.

The results of these tests indicate that the inhibitory nematode growth factor is nutritional in character, and that its effects are temporary.

46. *Further Studies on Hydrogen-ion Concentration as a Factor in Age Resistance to the Fowl Ascarid.* B. B. Riedel and J. E. Ackert, Kansas State College.

Hydrogen-ion concentration of the habitat of the fowl nematode *Ascaridia galli* as a possible factor in age resistance was mentioned to this body in 1945 when comparisons were made between 4-week and 13-week fowls. The studies, which have been continued, cover various regions of the alimentary tract of chickens up to 35 weeks of age.

Normal White Leghorn chickens reach the maximum resistance to the *Ascaridia* when they are about 17 weeks old. Had the study ceased with chickens 11 weeks old, it would have appeared that hydrogen-ion concentration might be a factor in reducing the growth rate of the *Ascaridia,* as the average pH reading at that age of chicken (6.09) was markedly lower than that at the 4-week age (6.44). As the older fowls were tested, however, the pH readings veered toward those of the chickens of the susceptible ages. For example, resistant chickens 17 weeks of age averaged 6.67 as compared with 6.51 for susceptible fowls 8 weeks old. The fact that the worm habitat in chickens 17 to 35 weeks of age had about the same hydrogen-ion concentration as did that of the young birds 1 to 8 weeks of age tends to remove hydrogen-ion concentration as a factor in age resistance of chickens to the *Ascaridia.*

No constant trend in hydrogen-ion concentration with age of fowls was observed for the following organs: proventriculus, gizzard, anterior duodenum, posterior duodenum (worm habitat), posterior intestine (at yolk sac diverticulum), and caecum (11 and 15 weeks).

47. *Age of* Ascaridia *Egg Culture a Factor in Worm Growth.* J. E. Ackert, Rhoda M. Cooper, and L. W. Dewhirst, Kansas State College.

Variability in results in experimental parasitology is one of the problems of the investigator. A number of possible factors in variability of the number and size of *Ascaridia galli* in chickens have been studied; but apparently not age of egg culture.

To test age of egg culture as a possible factor in variability, 1000 embryonated eggs of *Ascaridia galli* were taken at random from an old egg culture (120 days) and given in 100-egg lots to 10 young chickens. From a young egg culture (36 days), 1000 eggs were similarly taken and fed to 10 other young chickens of the same age.

Three weeks later, the test was terminated and the worms from each chicken collected, counted and measured. The results showed that the worms from the chickens fed from the old egg culture averaged 3.4 worms per fowl as compared with 10.2 worms from the young egg culture. As to growth, the worms from the old egg culture averaged 15.5 mm in length as compared with an average worm length of 23.6 mm from the young egg culture, a significant difference.

These results indicate that to avoid needless variability in size of worms, embryonated eggs for comparative infection experiments should be taken from egg cultures of approximately the same age.

48. *The Status of the Sodium Flouride Treatment for the Removal of Large Roundworms from Swine.* A. O. Foster, F. D. Enzie, R. T. Habermann, and R. W. Allen, U. S. Bureau of Animal Industry.

In consequence of a search for an improved treatment for the removal of large roundworms from swine, sodium fluoride, data on which were first published in July, 1945, has been found to be highly efficient in removing both ascarids and stomach worms, well tolerated when given in therapeutic dosages in dry, ground feed, and easy to administer. The treatment has been extensively investigated in the United States and Australia, and has received wide field use. It is replacing to an increasing extent the commonly employed swine ascaricides of recent date, namely, oil of chenopodium and phenothiazine, over each of which the sodium fluoride treatment possesses measurable net superiority when judged by the obvious criteria of safety, efficacy, ease of administration, and cost. The method of use that appears most satisfactory consists in the administration of the chemical in dry, ground feed, at a concentration of 1 per cent for a period of 1 day. While the effective dose rate is in the vicinity of 0.1 gram per pound of live weight, both critical investigation and clinical field experience have indicated that there is risk of intoxication if the chemical is administered in capsules or drenches, or in garbage, slops, or milk. The treatment is contraindicated in swine exhibiting symptoms of gastroenteritis. Rarely does the treatment give rise to symptoms other than occasional vomiting and softening of the feces.

49. *Screening Large Numbers of New Chemical Compounds for Anthelminthic Activity Using Infections of* Nippostrongylus muris *in mice.* Sterling Brackett and Alexander Bliznick, American Cyanamid Company, Stamford, Connecticut.

Factors of importance in selecting a parasite-host combination for use in large-scale screening of new compounds for leads to anthelminthic activity are: (1) ease of producing standardized experimental infections in large numbers of test animals, (2) smallness of host in order to conserve drug which is usually available in quantities of only a few grams in the case of new compounds, (3) availability of a uniform strain of host in large numbers at low cost, (4) ease of caring for and dosing host, (5) an easily read endpoint, and (6) reproducibility of results. Experimentally induced infections with *Nippostrongylus muris* in young mice (10–14 g) using worm counts at autopsy as the endpoint, have been found to meet to a satisfactory extent all of the above requirements, and permits a team of two persons to screen-test from 40 to 80 new compounds a week using as little as 0.3 g of each compound. Greatest emphasis has been on drug-diet method of drug administration. Standard anthelminthics such as hexylresorcinal, phenothiazine, β-naphthol, santonin, gentian violet and arecoline, which are not too volatile to be tested in this way, are ineffective. The only compounds found to have unquestionable activity thus far, namely trichloroacetamide and related compounds, only affect the larval stages migrating in the tissues. Whether these or other compounds which may be found active against *N. muris* in the future will have practical application can be determined only by trials against parasites of economic importance and in the natural host.

50. *Further Studies on the Maintenance of Cultures of* Endamoeba histolytica *without Viable Bacteria.* Leon Jacobs, National Institute of Health.

In an earlier paper (Am. J. Hyg., Sept. 1947) use of penicillin for elimination of viable bacteria from cultures of *Endamoeba histolytica* was described. Maintenance for over 3 months of one series of amoeba cultures after elimination of viable bacteria, and establishment of another series were reported. Since this report the second series was maintained for 6 months and two other series have been established.

In establishing cultures the medium used is Locke's-egg conditioned by growth of *Escherichia coli* for 24 hours after which the bacteria are heat-killed. This medium is inoculated from cultures of amoebae with *Clostridium perfringens,* and penicillin added to eliminate the viable bacteria introduced. Usually multiplication of amoebae is obtained through 2 or 3 transplants at 48 hours in such tubes. In later transplants the amoebae usually become scarce. Survival rarely follows but the series described have been derived from the few tubes in which it has occurred. After elimination of *C. perfringens,* penicillin is not needed. Cultures without viable bacteria show few amoebae, but multiplication does occur since a large series of cultures has been produced from a few tubes.

The rarity of survivors through penicillin treatment suggests that the successes obtained may have been due to acclimatization of amoebae to the insufficient medium. The penicillin technique has been exploited in hope of discovering accessory materials required by the amoebae. Dead yeast, yeast juices, ether-killed bacteria, and plasmoptyzates of bacteria have been tried as supplements without success.

51. *Studies on the Growth Requirements of Metacystic* Endamoeba histolytica. CHARLES W. REES AND LUCY V. REARDON, National Institute of Health.

Metacystic amoebae produced in microcultures from cysts of *Endamoeba histolytica* freed from bacteria by microisolation were studied in various kinds of egg media enriched with B vitamins and cholesterol, and in various wholly liquid media, including trypsin digests of egg, combinations of amino acids, extracts of liver and beef, filtrates of bacteral cultures, and suspensions of heat-killed bacteria. The metacystic amoebae failed to divide although they lived in some cases up to 96 hours. Inoculation of the microcultures with organism *t* resulted in division and limited growth of the amoebae. Transfer, by means of a microsyringe, of the bacteria-free metacystic amoebae to stock tubes of whole egg medium inoculated with organism *t* has regularly produced cultures of amoebae. Improvements in the technique of microisolation have led to the practice of isolating 100 cysts per microculture with the production of up to 40 bacteria-free metacystic amoebae per culture. Experimental work on growth requirements of the amoebae has thus been facilitated since in previous work not more than 25 cysts per culture were isolated.

52. *Culture Experiments on Intestinal Flagellates. IV. Selected Longevity Records to September 15, 1947.* D. H. WENRICH, University of Pennsylvania.

Employing the methods previously described, the life of flagellates in single culture tubes was prolonged by adding food (usually powdered gastric mucin or Loeffler's dried blood serum) as needed, and distilled water to maintain fluid level. For any culture reported below which was referred to in a table of a previous paper, the designation used there is indicated in parentheses. Longevity figures are in days.

(1) *Trichomonas hominis* from man (6A), 495; (2) *T. wenyoni* from white rat (Rat 1A, 1C), 965; (3) *T. wenyoni* from hamster (Ham. AR/2b), 1245; (4) same from a man who swallowed a culture (Ha/Ho 1B), 1185; (5) *T. batrachorum* from frog (*Rana pipiens*) (5C/1a), 1750 (nearly 5 years); (6) *T. prowazeki* from *Amphiuma means,* 546; (7) *Monocercomonoides* sp. from guinea-pig (G.-p. 2A), 683; (8) *M.* sp. from Japanese beetle larva (Jap. 3C), 882; (9) *M.* sp. from tipulid larvae (Tip. 3A, 3B), 872; (10) *M.* sp. from lizard (*Sceloporus* sp.), 331; (11) *Monocercomonas* (*Eutrichomastix*) sp. from same lizard, 331; (12) *Trimitus parva* from frog (*Rana pipiens*) (11A), 937; (13) *Hexamitus* sp. from bullfrog (*Rana catesbeiana*), 520. A new strain of *Trichomonas augusta* from *Rana pipiens* is being maintained in one-half strength Ringer's with Loeffler's dried blood serum and rice starch; longest survival to date in any one tube, 130 days.

No. 5 was started in water; all others in modified or in diluted Ringer's. No. 1 was maintained at 32–33° C; all others at room temperatures. All but nos. 5 and 7 are still positive.

53. *The Phase Microscope in the Examination of* Endamoeba. ERNEST HARTMAN AND GEORGE J. SCHEFF, The Chicago Medical School. (Also by demonstration.)

The use of the phase microscope permits the direct observation of internal structure of living *Endamoeba* free from the distortion of fixed material. The nuclei are prominent and show denser bodies somewhat different from the appearance of iron hematoxylin prepared material.

54. *The Fate of Various Species of Trypanosomes in* Triatoma. A. PACKCHANIAN, The University of Texas.

Laboratory-reared, normal *Triatoma gerstaeckeri* were allowed to feed on guinea pigs infected with *Trypanosoma gambiense* and *Trypanosoma rhodesiense*. Likewise, normal *Triatoma* were permitted to feed on rats experimentally infected with *T. lewisi*. Other batches of *Triatoma* were fed on mice (*Mus musculus*) infected with *T. duttoni*.

None of the *T. gambiense, T. rhodesiense, T. lewisi,* or *T. duttoni* multiplied in *Triatoma*. The trypanosomes survived a few days in the insect guts, their numbers gradually diminishing; at the end of ten days no viable flagellates were noted, and the susceptible animal inoculation tests with crushed *Triatoma* were all negative.

*T. gambiense, T. rhodesiense,* and *T. lewisi* were passed also into soft ticks (*Ornithodorus turicata*). None of these micro-organisms multiplied or survived in the ticks and at the end of about ten days susceptible animal inoculation tests were likewise negative for trypanosomes.

55. *Studies of Sheep Parasites. VIII. Overwintering of Nematode Larvae.* PHILIP A. HAWKINS AND MOACYR GOMES DE FREITAS, Michigan State College.

During a five-year period it was noted that there was a decided decrease in nematode egg counts, and an increase in concentration of hemoglobin during the late winter months in ewes and yearling lambs. In late February or March there were increased egg counts and a lowering of hemoglobin. It was assumed that this was produced by the development of infective larvae in the warmer environment of the barn where the sheep were kept. During the winter of 1946–47 examinations were made of the straw bedding in the sheep barn at regular intervals by a modified Baermann technique. No infective larvae were recovered between December 16, 1946 and April 7, 1947. Small numbers of infective larvae of *Nematodirus sp., Haemonchus contortus,* and other short tail larvae probably *Trichostrongylus* sp. were recovered on April 14, 1946. In one yearling ewe that died February 31, 1947, a few immature specimens of *H. contortus* were recovered. No immature nematodes were recovered from two yearlings dying February 21 and February 24, respectively. One lamb born March 7 died April 10 of pneumonia and at autopsy revealed 10 *Nematodirus* sp. and 1 *Trichostrongylus* sp.

Between early December and February 10, the mean temperatures in the straw bedding were usually below freezing. The week of February 10–17, the mean temperature was 38° F, February 17–24, it was 35° F and during March it was usually not below 40° F. Therefore under natural conditions of infection a mean temperature of approximately 40° F is required for the development of infective larvae. The increase in egg counts in late April is due to the ingestion of larvae during that month, but increases during the winter months are not correlated with the presence of infective larvae. These increases are referable to variations in the rate of egg production of the female worms which pass over the winter in the animal. The causes of this variation are unknown.

56. *The Effect of Aralen on* Giardia lambia *Infections in Children.* J. C. SWARTZWELDER AND T. C. PAPERMASTER, Louisiana State University.

In view of reported cures of giardiasis with Aralen diphosphate, the following observations are recorded. Five children infected with *Giardia lamblia* were treated with Chloroquine diphosphate (Aralen, SN7618) to determine whether or not this new antimalarial compound, like atabrine, was also effective against that intestinal flagellate. Prior to treatment, stool examinations in these cases showed large numbers of *G. lamblia* cysts in direct fecal smears. Both direct smear and zinc sulphate centrifugal flotation technics were employed during and following therapy to determine the presence or absence of the parasites in the stools. The dosages of Aralen employed and the approximate weight of the individuals treated were as follows: Cases 1, 2 and 5—35 to 40 lbs.—dosage 125 mg (½ tablet) of Aralen diphosphate twice daily for three days; case 3—26 lbs.—62 mg (¼ tablet) daily for 4 days; and case 4—30 lbs.—62 mg of drug daily for 3 days. No significant untoward reactions to the drug were observed clinically in the treated children. With the above dosage, there was a temporary disappearance or a reduction in number of *Giardia* cysts in the stool in four of the five cases following treatment. However, the parasites reappeared or persisted in the stool following a brief interval of apparent absence or depression. No reduction was noted in one case. These results do not preclude the possibility that higher dosages of Aralen, as used for adults, may be more effective against *G. lamblia* infections. Repeated stool examinations over an extended period after treatment are necessary to evaluate the permanent effect of the drug on *Giardia* infections.

57. *Bite of* Amblyomma americanum *Associated with Possible Tick Paralysis.* J. C. SWARTZWELDER AND J. H. SEABURY, Louisiana State University.

Two partially fed nymphs of *Amblyomma americanum,* the lone star tick, were found attached to the skin in the mid-thoracic region over the spine in a white, male child, 12 years of age. The boy was admitted to Charity Hospital of Louisiana at New Orleans, with a provisional diagnosis of poliomyelitis in September, 1946, between two and three days after the sudden onset

of his illness. Clinical manifestations and physical findings included a staggering shuffling gait, weakness of the lower extremities, fever (103.6° F), pharyngitis, headache, vomiting, nuchal stiffness, diminished patellar reflexes, diminished left abdominal reflex, slight tenderness of thigh and calf muscles and of the abdomen, and moderate inguinal and cervical lymphadenopathy. Spinal fluid examination revealed no increase in cell count. The patient improved rapidly subsequent to removal of the ticks. Examination of the ticks revealed that they were members of the genus *Amblyomma,* therefore they were submitted to a specialist for further study. G. M. Kohls of the Rocky Mountain Laboratory identified the specimens as partially fed nymphs of *Amblyomma americanum.* In view of the fact that this species has not previously been associated with tick paralysis, the case is reported. Although the possibility of the diagnosis of abortive poliomyelitis can not absolutely be excluded in this case, the occurrence of two partially fed ticks attached to the skin over the spine and the fact that rapid and spontaneous recovery occurred subsequent to removal of the ticks, appears to be more than coincidental.

58. *Report of Ten Cases of* Balantidium coli *Infection.* J. C. SWARTZWELDER, Louisiana State University.

In 1910, a fatal case of balantidiasis was reported from Charity Hospital at New Orleans. Since then at least 10 additional infections with *Balantidium coli* have been recorded at that institution. Nine of the ten previously unreported cases have been observed since 1936 and three were diagnosed in 1947. The patients ranged in age from 2 to 65 years. Five were fifteen years or older. Eight of the individuals were white and 9 were males. Five of the adults were farmers. All of the patients, except possibly one, resided in rural areas. Families of two patients, who were questioned on the subject, raised hogs. Eight of the patients complained of diarrhea, the most common symptom. Five individuals noted blood in their stools. Several individuals complained of weight loss. Diagnosis was made by stool examination, proctoscopy, and in one case the ciliate was detected in a section of appendix. Proctoscopy was done by attending physicians in at least six cases as a diagnostic measure, to study the lesions, or to observe the effect of therapy. The latter technic was a valuable supplement to stool examination. In only one case did the writer observe cysts of *Balantidium coli,* and these were accompanied by trophozoites, the usual diagnostic stage. Seven of the cases also had concomitant infections with two or more helminths, namely *Ascaris lumbricoides, Trichuris trichiura, Necator americanus,* and *Enterobius vermicularis.* Spontaneous temporary disappearance of the ciliate necessitates multiple stool examination for diagnosis and study over an extended period for evaluation of therapy.

59. *The Life History and Bionomics of* Heterakis bonasae *a Caecal Nematode of Bobwhite Quail,* Colinus virgianus *and* C. virgianus texanus. J. W. WARD, University of Mississippi.

The life history of *Heterakis bonasae* has been demonstrated to be direct. Day-old white leghorn chicks were utilized as the definitive hosts. Sixteen days is the average time for the undifferentiated eggs to develop into the infective larvae. Forty-seven days is the average time for development from infective larvae to mature worms. The eggs show a resistance to prolonged drought, moisture and low temperature. Undifferentiated eggs were found to develop normally after standing in ice for thirty days. Repeated wetting and drying had no effect upon the viability of undifferentiated eggs. Eggs developed to normal infective larvae after drying for thirteen months.

Young worms were found to burrow into the mucosa at the junction of the small intestine and the caecae.

60. *Further Taxonomic Studies on Internal Parasites of Horses and Mules.* J. W. WARD, University of Mississippi.

Results of this study are based upon the findings at autopsy of twenty-four horses and mules. The age of the animals varied from fifteen days to twenty years or more. Age of animals and parasite load could not be correlated. Animals three weeks of age were found to be heavily parasitized with three or more nematodes. Fourteen genera and nineteen species of parasites were recorded, as follows: *Gastrophilus nasalis; G. intestinalis; Parascaris equorum; Strongylus equinus; S. vulgaris; S. edentatus; Triodontophorus minor; T. serratus; Cylicocercus goldi; Cylicocyclus elongatus; C. nassatus; Oxyurus equi; Dictyocaulus arnfieldi; Setaria equina; Strongyloides sp.; Anoplocephala sp.; Trichonema sp.; Habronema sp.; Gongylonema sp.*

61. *Studies on Parasites and Food Habits of Foxes.* J. W. WARD, University of Mississippi.

The results of this study are based upon the findings at autopsy of seventeen wild gray foxes collected by trapping from the vicinity of Pontotoc and Springville, Mississippi. Three animals were examined for external parasites. Fifteen of the seventeen animals, or 88%, were found to be infected with the cestode *Taenia pisiformis.* The number of individual scoleces per

host varied from one to fifty-four. The average number being thirteen. Two foxes, or 12%, were infected with *Toxacara canis*. One animal was infected with *Uncinaria stenocephala*. Two external parasites were recovered from one animal, namely, *Cediopsyllus simplex* and *Dermacentor variabilis*. Stomach contents showed the common food to be field rats.

62. *Longevity and Rates of Infectivity of the Free-Swimming Miracidia of* Schistosoma mansoni. José F. Maldonado and J. Acosta-Matienzo, School of Tropical Medicine, San Juan, Puerto Rico.

During the study of the larval cycle of *S. mansoni* in *Australorbis glabratus*, several problems of epidemiologic importance arose. The first which has occupied our minds is the question of how long do the free-swimming miracidia of this parasite live and to what extent are they capable of penetrating into the snail with increasing age. Normal, recently passed eggs, obtained from the same patient throughout the experiment, were isolated singly in rain-water in watch glasses and continuously observed under the dissecting microscope, to determine their exact time of hatching. From the moment of hatching and thereafter at exact hourly intervals, a small *A. glabratus* was exposed to each miracidium and whether penetration occurred was determined. Slightly over 100 miracidia were used for each exposure interval.

The data show that the longevity of the free-swimming miracidium of *S. mansoni* is eight to nine hours. Seventy per cent of the miracidia were able to penetrate into the snail host immediately after hatching. The percentage of survival and successful penetration were as follows: one hour, 65.4; 2 hours, 65.0; 3 hours, 52.0; 4 hours, 35.9; 5 hours, 36.9; 6 hours, 11.5; 7 hours, 10.8; 8 hours, 3.9. At nine hours none of the miracidia were alive. Hatchability, mortality and infectivity varied markedly from day to day.

A negligible number of eggs was able to hatch beyond the 48th hour after the stools were put in contact with water.

63. *An Investigation of Some Possible Sources of Trichina Infection in a Central Illinois Community.* Wayne W. Wantland and Paul Martin, Illinois Wesleyan University.

A study was made of thirty-seven hogs, thirty-two rats, and ten samples of pork products. A small packing plant, two farms where garbage is fed to hogs, three city dumps and local stores were the sources of material. Three methods of examination were used: (1) direct microscopic study consisting of clamping muscle tissue between two glass slides and examining with compound microscope, (2) a modified Baermann digestion method and microscopic examination of the residue following centrifugation, and (3) microscopic examination of intestinal contents of rats. No adults or larvae of *Trichinella spiralis* were found.

64. *The Localization of Adult* Trichinella spiralis *in the Intestinal Tract of Young and Old Mice.* John E. Larsh, Jr., and James R. Hendricks, University of North Carolina.

Using old rats for class study it has been noted that the majority of *T. spiralis* adults are found in the first half of the small intestine. When the reverse was found to be the case in young rats, it suggested an interesting relationship worthy of further study.

White mice were used in four similar experiments completed thus far. A total of 27 young mice (4 to 6 weeks) and 26 old mice (12 to 16 weeks) were used. Each animal was infected with 300 *T. spiralis* larvae and counts were made of adults found five days later. The results of all four experiments were similar. The young mice averaged 20% development of adults and of this number (60) 36% were found in the first half of the small intestine and 64% in the second half. The old mice averaged 30% development of adult worms and of the total (91) 84.7% were found in the first half of the small intestine and 15.3% in the second half. This showed a striking difference, therefore, in the location of adult *T. spiralis* in the intestinal tract of young and old mice. The intestinal emptying time of young mice is much greater than that of old mice, so that it may be a factor involved in this phenomenon. Studies are in progress using drugs, at present morphine sulphate, to test this possibility by artificially slowing the intestinal emptying time of young mice after infection.

65. *The Effect of Thyroid and Thiouracil on the Natural Resistance of Mice to Infection with* Hymenolepis. John E. Larsh, Jr., University of North Carolina.

The mice used were divided into five groups. Those of group A were five months old and were given each day by mouth 2 mg of thyroid extract. Group B mice of the same age served as untreated controls for group A. The mice of group C were one month old and each was given 2 mg of thiouracil (American Cyanamid Company). Those of group D were the same age but untreated. The last group, 2½ months old, included as controls on age resistance, was injected with normal saline. After one month of treatment the animals were infected. Accounting for the age of the animals of the various groups, there was little difference noted in the percentage development of *Hymenolepis*. The food intake likewise was similar for all groups.

In a repeat of this experiment, grouping the mice as above and using 3 mg of thyroid and 2.2 mg of thiouracil, a great difference was noted. The thyroid animals showed a much higher percentage development than their controls of the same age, whereas all of the thiouracil animals showed about the same rate of development. Th food intake of the thyroid mice was higher than for their controls, whereas there was little difference noted in the thiouracil groups. There is indication, therefore, that thyroid given to old mice has an adverse effect upon normal age resistance. It is well known that hyperthyroidism produces a drain on the vitamin stores of the body. Therefore, these animals may have exhibited decreased age resistance to *Hymenolepis* as a result of vitamin deficiencies, which have already been shown to be involved in alcoholic debilitation of mice infected with this parasite.

66. *The White Rat and Guinea Pig as Hosts for the Larvae of the Brown Dog Tick,* Rhipicephalus sanguineus. GEORGE W. LUTTERMOSER, University of Pennsylvania.

An attempt was made to rear the different stages of the life cycle of the brown dog tick, *Rhipicephalus sanguineus,* with white mice, white rats and guinea pigs as hosts. Eggs deposited by female ticks which had previously engorged on dogs, were placed in Mason pint jars with tops of fine copper screen (475 mesh per square inch) held in place by standard jar rings. The jars were stored in a saturated atmosphere of a small humidity chamber. At room temperature the eggs hatched in about six weeks. At least 100 larval ticks were then transferred to an animal which had been previously isolated in a battery jar partially filled with shavings and surrounded by oil. Larvae were collected from the sides of the jar, from the shavings or from each animal during a period of a week and were returned to the Mason jars and humidity chamber for observation of further development. The nymphs were transferred to the animals maintained under the same conditions as described above. Unengorged nymphs and adult *R. sanguineus* were collected from dogs and were handled in the same fashion as the larvae.

About 5% of the larvae of *R. sanguineus* fed on guinea pigs in three tests, and they engorged on shaven white rats in each of the two tests made. The engorged larvae recovered from both the rats and guinea pigs molted and were again placed on these animals, but they failed to engorge. The nymphal and adult ticks collected from dogs likewise failed to engorge on the rodents. The larvae did not engorge on four unshaven white rats or on a white mouse. These data would seem to indicate that *R. sanguineus* can adapt itself to a life cycle with more than one host.

67. *Susceptibility and Immunity of Marine Fishes to* Benedenia (= Epibdella) melleni (*MacCallum*), *a Monogenetic Trematode. III. Natural Hosts in the West Indies.* ROSS F. NIGRELLI, New York Aquarium, New York Zoological Society.

*Benedenia melleni* was originally described in 1927 from captive marine fishes in the New York Aquarium where a large variety of spiny-rayed species was found susceptible. Some can develop a partial or total immunity; others are always immune. Infection spreads rapidly to all susceptible fishes kept in a closed circulation, constantly recirculating the same water. Death from heavy infestation often occurs. A survey of Benedeniaisis among fishes of Bimini, B.W.I., showed the following to be naturally infected, but never with more than three of the parasites: *Epinephelus striatus, Lutianus apodus, Chaetodon ocellatus, C. striatus, C. capistratus, Pomacanthus arcuatus, P. paru, Holacanthus tricolor* and *H. ciliaris.* These are species that become most heavily parasitized in captivity. The following fishes are known to become infected in captivity, but were found free of parasites at Bimini: *Holocentrus ascensionis, Caranx* spp., *Haemulon* spp., *Acanthurus caeruleus, A. hepatus, Balistes vetula, Lactophrys bicaudalis* and *Diodon hystrix.* The following species, kept in a large, open-work, stockade-like enclosure and a concrete tank with open "windows," off the dock at Bimini, were heavily parasitized: *trachinotus goodei, C. ocellatus, S. striatus, P. arcuatus, P. paru, H. ciliaris, Melichthys piceus* and *Alutera scripta.* An unlimited supply of fresh sea-water does not prevent heavy infestations. Proximity to infected fishes or to possible resting places for developing eggs of the parasite are apparently the critical factors.

68. *Parasites of the Ranidae* (*Amphibia*). *I.* A. C. WALTON, Knox College.

The Ranidae are primarily found in the Eastern Hemisphere, particularly in Africa and the tropical and subtropical Orient. One genus (*Rana*) is cosmopolitan in distribution. Among the *Arthroleptinae* (Africa) the following hosts and parasites have been recorded: 1. *Arthroleptis minutus—Endotrombicula penetrans* (Acarina); and 2. *A. ogoensis—Cylindrotaenia ?americana* (Cestoda). 1. *Phrynobatrachus graueri—Aplectana congolense* (Nematoda), and a larval mite of Loveridge, 1929 (Acarina); and 2. *P. natalensis—Balantidium entozoon* and *Opalina natalensis* (Protozoa), and *Schöngastia pillarsi* (Acarina). Among the *Astylosterninae* (Africa) the records are: *Astylosternus robustus—Africana astylosterni, Amplicaecum novempapillatum,* and *Oxysomatium chameleonis* (Nematoda). The *Petropedetinae* (Africa) record

is: *Arthroleptides dutoiti—Aplectana* sp? of Loveridge, 1926 (Nematoda). Records for members of the *Raninae* (Cosmopolitan) are as follows: *Ooeidozyga lima* (China)—*Diplodiscus japonicus,* larval *Encyclometra asymmetrica,* and larval *Pharyngostomum cordatum* (Trematoda). 1. *Rana acquiplicalata* (Mozambique)—*Cylindrotaenia ?americana* (Cestoda). 2. *R.. adspersa* (Africa)—*Agamascaris africana* (larval Nematoda); *Ophiotaenia schultzei* (Cestoda); and *Dactylosoma* sp.? of Wenyon, 1931, *Hexamita ranae,* and *Protoopalina mossambicensis* (Protozoa). 3. *R. aesopus* (U.S.A.)—*Cosmocercoides dukae, Foleyella* sp.? of Causey, 1938, and larval *Ophidascaris labiatopapillosa* (Nematoda); and *Brachycoelium salamandrae* and *Megalodiscus temperatus* (Trematoda). 4. *R. agilis* (Europe)—*Nematotaenia dispar* (Cestoda); and *Acanthocephalus ranae* (Acanthocephala). 5. *R. albilabris* (Africa)—larval *Filaria* sp.? of Schwetz, 1930 (Nematoda); and *Dactylosoma ranarum* and *Trypanosoma rotatorium* (Protozoa). 6. *R. amurensis* (Siberia)—*Haematoloechus schultzei* and *H. sibericus* (Trematoda). 7. *R. angolensis* (Africa)—*Haemogregarina theileri, Trypanosoma nelspruitense, T. rotatorium* and *T.* spp.? of Laveran, 1904, and Laveran & Mesnil, 1912 (Protozoa). 8. *R. angulosa* (China)—*Glypthelmins staffordi* (Trematoda). 9. *R. areolata* (U.S.A.)—*Cosmocercoides dukae* (Nematoda); *Haplometrana utahensis* and *Megalodiscus temperatus* (Trematoda); and *Balantidium* sp.? of Metcalf, 1923, and *Opalina kennicotti* (Protozoa).

69. *Parasites of the Ranidae (Amphibia). II.* A. C. Walton, Knox College.

10. *Rana arvalis* (Europe)—*Aplectana acuminata, Cosmocerca commutata, Oswaldocruzia filiformis, Oxysomatium brevicaudatum* and *Rhabdias bufonis* (Nematoda); *Brandesia turgida,* larval *Distoma* sp.? of Tiniofeev, 1900, *Gorgodera cygnoides, Gorgoderina vitelliloba, Haplometra cylindracea, Monostoma ellipticum, Opisthioglyphe endoloba, Opisthodiscus subclavatus, Pleurogenes claviger, P. medians, Polystoma integerrimum* and *Prostocus confusus* (Trematoda); and *Acanthocephalus ranae* (Acanthocephala). 11. *R. arv. altaica* (Siberia)—*Haematoloechus sibericus* and *Pleurogenes intermedius* (Trematoda). 12. *R. arv. isaitschikovi* (Europe)—*Aplectana acuminata, Cosmocerca ornata, Oswaldocruzia filiformis, Oxysomatium brevicaudatum, O. longispiculum* and *Rhabdias bufonis* (Nematoda); and *Gorgoderina vitelliloba, Haplometra cylindracea* and *Opisthioglyphe histrix* (Trematoda). 13. *R. aurora* (U.S.A.)—*Cosmocercoides dukae, Oswaldocruzia waltoni* and *Rhabdias joaquinensis* (Nematoda); *Glypthelmins californiensis, Gorgoderina aurora, G. multilobata, Lecithodendrium lynchi* and (in tadpoles) larval *Paralechriorchis syntomentera* (Trematoda); *Crepidobothrium olor* (Cestoda); and *Opalina obtrigonoidea lata* (Protozoa). 14. *R. aur. draytoni* (U.S.A.)—*Spironoura pretiosa* (Nematoda); *Cephalogonimus brevicirrus,* larval *Clinostomum* sp.? of Ingles, 1936, *Glypthelmins californiensis, Haematoloechus kernensis, H. oxyorchis* (exper.) and *H. tumidus* (Trematoda); and *Hexamita batrachorum, H. ovata, Opalina draytonii, Trichomonas augusta, Trypanosoma* sp.? of Wenrich, 1935, and *Zelleriella ranaxena* (Protozoa). 15. *R. boylii* (U.S.A.)—larval *Clinostomum* sp.? of Ingles, 1936, *Glypthelmins californiensis, Gorgoderina multilobata, Haematoloechus buttensis, H. oxyorchis* (exper.) and *Halipegus aspina* (Trematoda); Paruterine larvae of Ingles, 1936 (Cestoda); and *Hexamita batrachorum, H. ovata, Opalina virguloidea* and *Trichomonas augusta* (Protozoa). 16. *R. boylii sierrae* (U.S.A.)—*Spironoura pretiosa* and *S. ranae* (Nematoda). 17. *R. capita* (?=*R. aesopus*) (U.S.A.)—*Opalina obtrigonoidea lata* (Protozoa). 18. *R. cantabridgensis* (U.S.A.)—*Megalodiscus temperatus* (Trematoda). 19. *R. cancrivora* (Asia)—*Kiricephalus pattoni* (Porocephalida).

70. *Parasites of the Ranidae (Amphibia). III.* A. C. Walton, Knox College.

20. *Rana catesbiana* (N. Amer.)—larval *Abbreviata ranae,* larval *Agamascaris odontocephala, Cosmocercoides dukae,* larval *Dujardinia* sp.? of Brandt, 1936, larval *Eustrongylides wenrichi, Foleyella ranae,* larval *Icosiella quadrituberculata, Multicaecum tenuicolle, Ophidascaris labiatopapillosa, Oswaldocruzia collaris, O. leidyi, Oxysomatium americana, Rhabdias ranae, Spinitectus* sp.? of Trowbridge & Hefley, 1934, *Spironoura catesbianae, "Spiroptera" mugientis* and *Strongyluris ranae* (Nematoda); larval *Alaria mustelae, Allassostoma parva,* larval Amphistome of Trowbridge & Hefley, 1934, larval *Aurodistomum chelydrae* (exper. in tadpoles), *Cephalogonimus americanus* (?=*C. retusus*), *Cercaria vesiculosa,* larval *Clinostomum complanatum,* larval *Dasymetra conferta* (in tadpoles), larval *D. villicaeca* (in tadpoles), *Glypthelmins quieta, G. subtropica, Gorgodera amplicava, G. cygnoides, G. minima, Gorgoderina attenuata, G. simplex, G. ?vitelliloba, Gyrodactylus* sp.? of Stunkard & Dunihue, 1933 (on tadpoles), *Haematoloechus breviplexus, H. complexus, H. floedae, H. longiplexus, H. parviplexus, H. variegatus, H. varioplexus, Halipegus amherstensis, H. eccentricus, H. occidualis, Loxogenes arcanum, Megalodiscus intermedius, M. temperatus,* larval *Neorenifer aniarum* (in tadpoles) and *Opisthodiscus ?subclavatus* (Trematoda); *Cylindrotaenia americana, Ophiotaenia magna, O. saphena* and Proteocephalid cysts of Brandt, 1936 (Cestoda); larval *Centrorhynchus* sp.? of Brandt, 1936 (Acanthocephala); *Amphileptus branchiarum, Cytamoeba bacterifera, Discophrya* sp.? of Metcalf, 1923, *Entamoeba ranarum, Epistylis* sp.? of Wenrich, 1935 (on tadpoles),

*Haemogregarina catesbianae, Hexamita intestinalis, Ichthyobodo necatrix* (in tadpoles), *Karyolysus* sp.? of Brandt, 1936, *Lankesterella canadensis L.* spp.? of Brandt, 1936, and Wenyon, 1933, *Leptotheca ohlmacheri, Mastigamoeba hylae, Nyctotherus ?cordiformis, Opalina larvarum* (in tadpoles), *Opercularis* sp.? of Wenrich, 1935 (on tadpoles), *Plasmodium catesbianae, Retortamonas dobelli, Rhabdostyla* sp.? of Wenrich, 1935 (on tadpoles), *Spirochaeta manitoui, Trichomonas augusta, T. batrachorum, T.* sp.? of Thompson, 1934, *Trichodina* spp.? of Diller, 1928, and Wenrich, (on tadpoles), *Trypanosoma inopinatum, T. rotatorium, T.* sp.? of Hegner, 1920, and *Vorticella* sp.? of Wenrich, 1935 (on tadpoles) (Protozoa); *Macrobdella ditetra* (Annelida); *Hannemania penetrans* (Acarina); and *Culex territans* (Diptera).

## Symposium on Exoerythrocytic Forms of Malarial Parasites

*Program*

71. *Introduction to Symposium.* CLAY G. HUFF, Naval Medical Research Institute.

Some of the historical background for the following five papers on exoerythrocytic forms of malarial parasites is given. In addition, the relationship between these stages and other malaria-like organisms and between the avian and hypothetical human forms is discussed. An attempt is made to orient the subjects presented in the five papers and to indicate some of the conclusions that can be drawn as well as the limitations imposed by our lack of knowledge.

72. *A Search for the Pre-erythrocytic Stages of* Plasmodium vivax *and of* P. cynomolgi. CLAY G. HUFF, Naval Medical Research Institute, AND FREDERICK COULSTON, E. I. du Pont de Nemours and Company.

Using methods which were successful for finding pre-erythrocytic stages of four species of avian malaria an intensive search was made for the corresponding stages of *P. vivax* in human volunteers. Salivary glands from infected *Anopheles quadrimaculatus* were inoculated in minimum amounts of fluid into the skin, lymph nodes, muscle and isolated veins of volunteers in the Manteno State Hospital and the Stateville Penitentiary (Illinois). The inoculated area was then biopsied, fixed, sectioned, and stained by methods described in our earlier papers. Although remnants of the inoculated material were usually located in the sections no pre-erythrocytic stages were discovered. Material from 24 biopsied areas of skin, 7 biopsied lymph nodes, 4 isolated veins, and 1 muscle biopsy were examined. The intervals at which the biopsies were taken extended from 2 to 150 hours but the majority were made at 24, 48, and 72 hours. In attempts to demonstrate the presence of viable parasites in the inoculated areas by subinoculation these areas were biopsied and subinoculated or grafted into other volunteers. Infections developed in all of the original recipients of sporozoites but none developed in volunteers receiving the biopsied areas of skin. Since pre-erythrocytic stages of some avian malarias will develop in hosts which do not develop parasitemia, attempts were made to find similar stages in the sites of inoculation of sporozoites of *P. vivax* in liver, spleen, bone marrow, and skin of five species of monkeys (*Macaca mulata, Cercopithecus aethiops sabaeus, Cercopithecus a. pygerythrus, Cercocebus fuliginosus,* and *Papio papio*). The findings were negative. Similar experiments with *P. cynomolgi* and *Macaca mulata* at approximately 24, 48, and 72 hour intervals in liver, spleen, bone marrow, and skin also yielded negative findings.

73. *The Chemotherapy of Malaria in Relation to Our Knowledge of Exoerythrocytic Forms.* G. ROBERT COATNEY AND W. CLARK COOPER, National Institute of Health.

In this paper, the authors attempt to bring together all information relating to the action of drugs upon the exoerythrocytic forms in malaria. Emphasis is given to the direct proof that the sulfonamides and certain other compounds destroy these forms in *P. gallinaceum* malaria. The indirect evidence obtained from chemotherapeutic studies relative to the occurrence and nature of exoerythrocytic forms in the higher vertebrates is critically discussed.

74. *The Chemotherapy and Immunology of Pre-erythrocytic Stages in Avian Malaria.* FREDERICK COULSTON, E. I. du Pont de Nemours and Company, AND CLAY G. HUFF, Naval Medical Research Institute.

With the development of a technique whereby the tissue stages of avian malarial parasites could be studied, it was possible to consider immunological and chemotherapeutic aspects of the pre-erythrocytic stages. In general, the visible effects on the parasite and the host seem to be similar, whether chemotherapy is employed or the natural and acquired immunity of the host is allowed to follow the normal course of events. Elsewhere, the authors have considered such important factors in the immunology of avian malaria as the normal and abnormal host and the tissue-blood barrier. This work will be reviewed and integrated.

Chemotherapeutic agents of a prophylactic or suppressive type were given to chickens in-

fected with sporozoites of *P. gallinaceum*. The cryptozoites and metacryptozoites of these birds were studied by histological methods. Blood levels of the drugs were obtained whenever possible.

Taken as a whole, no drug tested was capable of preventing the development of the cryptozoites. However, certain drugs, such as sulfadiazine, effectively prevented the growth of the succeeding generations of metacryptozoites, whereas quinine and quinicrine did not prevent their development. An important consideration is the fact that all good antimalarial drugs tested exhibited some effect on the metacryptozoites.

75. Richard Janvier Porter, University of Michigan.
(Invited Paper; No Abstract Received.)

76. *Response of Exo-erythrocytic Forms to Alterations in the Life-Cycle of* Plasmodium gallinaceum. Victor H. Haas, Aimee Wilcox, R. L. Laird, Frances Moore Ewing, and Nell Coleman, National Institute of Health and University of Tennessee.

It is known that in *Plasmodium gallinaceum* passed alternately through mosquitoes and chicks, exo-erythrocytic forms attain their greatest density near the end of the prepatent period, while in passage by blood inoculation alone, these forms become prevalent after parasitemia has subsided.

This report describes another type of host-parasite relationship, in which profuse growth of exo-erythrocytic forms kills the host before erythrocytic parasites become numerous. This phenomenon occurs: (a) In chick embryos infected by mosquitoes. (b) In chicks and chick embryos inoculated with brain emulsions containing exo-erythrocytic forms. In embryos, the accompanying few erythrocytic forms produce no pigment. These infections maintain their characteristics in both chicks and chick embryos through serial brain emulsion inoculations, but are convertible by 3 or 4 blood passages to the classical blood inoculation type. In such converted strains, gametocytes are extremely rare, but low-grade mosquito infections are obtainable. (c) In chicks inoculated with sporozoites from mosquitoes previously infected on chicks of the blood-inoculated series.

This type of host-parasite relationship, accompanying alterations in the life cycle of *P. gallinaceum*, represents a response on the part of the exo-erythrocytic forms which could not generally occur under natural conditions, since death of the host before erythrocytic forms become numerous would prevent cyclical development of the parasite.

# AMERICAN SOCIETY OF PARASITOLOGISTS

## CONSTITUTION

(Including revisions of December 30, 1931, December 28, 1932, December 29, 1933, December 31, 1940, December 30, 1941, and December 27, 1946.)

### NAME AND OBJECT

The name of the society is the American Society of Parasitologists.

The object of the society is the association of workers in the field of Parasitology for the presentation and discussion of new or important facts and problems in that science and for the adoption of such measures as will tend to the advancement of parasitological teaching and investigation in this country.

### MEMBERSHIP

The members of the society shall be of two classes, active and foreign honorary.

Any person with suitable educational qualification interested in parasitology may be a candidate for active membership.

Any foreign scientist who has made eminent contributions to Parasitology may be eligible for honorary membership.

Candidates for membership shall be elected by the Council.

### OFFICERS

The officers of the society shall be a President and a Vice-President, who shall be elected for one year; a Secretary and a Treasurer, who shall be elected for two years; and members at large of the Council.

The Council shall consist of the President, the Vice-President, the Secretary, the Treasurer, the Chairman of the Editorial Committee, and eight members elected by ballot from the society at large, two for four years, two for three years, two for two years and two for one year. After the first year two members at large of the Council shall be elected each year to serve four years.

If any vacancy occurs among the officers, the Council is authorized to appoint a member to fill out the unexpired portion of the current year.

The routine business of the society shall be administered by the Council.

Five shall constitute a quorum of the Council.

### DUES

The dues, to include subscription to the JOURNAL OF PARASITOLOGY, shall be four dollars the year for active members, unless changed by vote of the society.

### MEETINGS

There shall be an annual meeting and such other scientific or business meetings as the Council shall determine.

During the annual meeting a business meeting will be held for the election of officers for the ensuing year and for the transaction of other business.

### JOURNAL OF PARASITOLOGY

This Journal, the property of the society, is its official organ. Responsibility for its conduct shall rest with the Council which shall select the editorial staff and set the price of subscription.

### ENDOWMENT FUND

Provision is made for the establishment of a permanent endowment fund, the principal of which may be expended only by a three-fourths vote of all members of the Council and approval by a three-fourths vote of the members of the society present at a regular meeting. The Council shall be entrusted with the maintenance of the fund, and the use of the income therefrom.

### AMENDMENT

On recommendation of a two-thirds vote of the Council, the constitution may be amended by a two-thirds vote of the members present at any regular business meeting of the society, provided that at least 30 days' notice has been given to the membership of the proposed amendment.

## BY-LAWS

### MEMBERSHIP

1. *Election of Members.* An affirmative vote of all Council members present at a meeting shall be necessary for the election of candidates for membership. If the vote is taken by mail ballot, an affirmative vote of all members of the Council replying within thirty days shall be required.

2. *Members in Good Standing.* Members in good standing are those whose current dues are paid.

3. *Delinquent Members.* The JOURNAL OF PARASITOLOGY shall not be sent to members in arrears, and members in arrears for the current year and two previous years shall be dropped from the roll of the society at the end of the current year.

4. *Reinstatement of Delinquent Members.* Members dropped for non-payment of dues, or who have resigned, may be reinstated by the payment of all dues in arrears. Otherwise, the applicant must apply for election as a new member.

5. *Non-subscribing Members.* Where a second membership in the society is taken in the same immediate family, the second member may join upon the payment of annual dues of one dollar, but without receiving the JOURNAL OF PARASITOLOGY.

6. *Honorary Life Members.* Upon unanimous vote, the Council may recommend that the society confer honorary life membership upon distinguished American parasitologists over sixty years of age. Honorary Life Members shall enjoy full membership privileges and shall be exempted from the payment of dues. The number of Honorary Life Members at any one time shall be limited to five.

7. *Foreign Honorary Members.* Upon unanimous vote, the Council at its annual meeting may elect Foreign Honorary Members. No two men from the same country shall be elected in the same year. The number of Foreign Honorary Members at any one time shall be limited to twelve. Foreign Honorary Members may receive the JOURNAL OF PARASITOLOGY upon payment of membership dues.

### PRESENTATION OF PAPERS AT ANNUAL MEETINGS

1. Except for invited papers, and papers coming to the American Society of Parasitologists program through joint sessions with another society or section, all persons presenting papers must be members of the society in good standing, or must be introduced by a member in good standing.

2. Each member of the society in good standing may be allotted not more than fifteen minutes of program time, to be used in person or by a non-member introduced by him. If the program is crowded, the maximal allotment of time may be reduced to ten minutes.

3. Papers offered for presentation too late to be included on the printed program may be presented at the conclusion of any of the scientific sessions provided that the presiding officer obtains the consent of the members present.

### OFFICERS

1. The Council shall act as a nominating committee and at the annual meeting shall submit to the society at least one nominee for each office to be filled. The Secretary shall invite the members of the society to submit nominations for consideration by the Council.

2. The Treasurer of the society shall act also as Treasurer for the JOURNAL OF PARASITOLOGY and shall be bonded for the sum of two thousand dollars.

3. A sum of fifty dollars shall be allotted annually to the Secretary, to the Treasurer, and to the Chairman of the Editorial Committee for attendance at the annual meeting.

### MANAGEMENT OF THE JOURNAL OF PARASITOLOGY

1. The JOURNAL OF PARASITOLOGY, as the official organ of the society, shall be managed by an Editorial Committee appointed by the Council for a five-year period, and shall consist of one Protozoologist, one Helminthologist, and one Entomologist, one of whom shall be appointed by the Council to act as Chairman.

2. The Editorial Committee shall be assisted by an Editorial Board consisting of twelve members appointed by the Council for a four-year period in such a way that three members will retire and three new members shall be elected each year. These shall be elected on the basis of attainment, interest in the Society, geographical location, and representation of the various fields of the science.

3. The price of the JOURNAL OF PARASITOLOGY shall be five dollars per volume, except to members of the American Society of Parasitologists who shall receive it as a membership privilege included in the annual dues of four dollars.

### ENDOWMENT FUND

1. Council shall select a Custodian of the Endowment Fund and two associates to whom it may delegate responsibility for management of the fund. The Custodian shall make an annual accounting to Council and such other reports as Council may request. The approval of two of the three custodians shall be necessary for the purchase, sale or exchange of securities. One of the three custodians shall be the Treasurer of the society and his signature shall be required on all vouchers of expenditure from the fund.

### ADDITIONS AND AMENDMENTS

1. Additional by-laws may be created by a two-thirds vote of Council members present at a meeting, or by an affirmative vote of nine Council members in a ballot conducted by mail. By the same procedure existing by-laws may be repealed, amended or suspended.

# AMERICAN SOCIETY OF PARASITOLOGISTS

*Officers for 1947*

HARLEY J. VAN CLEAVE, University of Illinois ..... *President*
CLAY G. HUFF, Naval Medical Research Institute ..... *Vice-President*
JAMES T. CULBERTSON, University of Arkansas ..... *Secretary*
ROBERT M. STABLER, Colorado College ..... *Treasurer*

*Council Member Ex Officio*[1]

HORACE W. STUNKARD, New York University ..... *Chairman, Editorial Committee*

*Council Members at Large*
*(with date of expiration of term)*

1950 EMMETT W. PRICE, U. S. Bureau of Animal Industry
1950 MARTIN D. YOUNG, U. S. Public Health Service
1949 WILLARD H. WRIGHT, U. S. Public Health Service
1949 THOMAS W. M. CAMERON, McGill University
1948 GILBERT F. OTTO, Johns Hopkins University
1948 G. ROBERT COATNEY, National Institute of Health
1947 HAROLD W. BROWN, Columbia University
1947 CORNELIUS B. PHILIP, U. S. Public Health Service

*Representatives of the Society on the Council of the American Association for the Advancement of Science*
(2-year terms expire 1947)

G. ROBERT COATNEY WILLARD H. WRIGHT

*Representatives of the Society on the Council of the Union of American Biological Societies*
(3-year terms expire 1948)

DONALD L. AUGUSTINE ROBERT M. STABLER

*Editorial Committee of the Journal of Parasitology*

HORACE W. STUNKARD, *Chairman* ..... to serve until 1948
WILLIAM A. RILEY ..... to serve until 1948
DAVID H. WENRICH ..... to serve until 1948

*Editorial Board of the Journal of Parasitology*

1950 RICHARD J. PORTER, University of Michigan
1950 WILLIAM TRAGER, Rockefeller Institute for Medical Research
1950 ARTHUR C. WALTON, Knox College
1949 LLOYD E. ROZEBOOM, Johns Hopkins University
1949 WILLIAM W. CORT, Johns Hopkins University
1949 RAYMOND M. CABLE, Purdue University
1948 LLOYD A. SPINDLER, U. S. Bureau of Animal Industry
1948 CHARLES W. REES, National Institute of Health
1948 WILLIAM L. JELLISON, U. S. Public Health Service
1947 LOWELL T. COGGESHALL, University of Michigan
1947 JOHN T. LUCKER, U. S. Bureau of Animal Industry
1947 NORMAN R. STOLL, Rockefeller Institute for Medical Research

*List of Former Officers*

| | *President* | *Vice-President* |
|---|---|---|
| 1925 | HENRY B. WARD* | SAMUEL T. DARLING* |
| 1926 | CHARLES W. STILES* | CHARLES A. KOFOID* |
| 1927 | RICHARD P. STRONG | EDWIN LINTON* |
| 1928 | CHARLES A. KOFOID* | ROBERT HEGNER* |
| 1929 | NATHAN A. COBB* | GEORGE R. LARUE |
| 1930 | WILLIAM W. CORT | ERNEST CARROLL FAUST |

[1] Beginning in 1942, the Chairman, Editorial Committee, became ex officio member of Council.

* Deceased.

| | | |
|---|---|---|
| 1931 | William A. Riley | Asa C. Chandler |
| 1932 | Maurice C. Hall* | William H. Taliaferro |
| 1933 | William H. Taliaferro | Fred C. Bishopp |
| 1934 | Ernest E. Tyzzer | James C. Ackert |
| 1935 | Charles F. Craig | Harley J. Van Cleave |
| 1936 | Robert Hegner* | William B. Herms |
| 1937 | George R. LaRue | David H. Wenrich |
| 1938 | Fred C. Bishopp | Elery R. Becker |
| 1939 | Horace W. Stunkard | Henry E. Meleney |
| 1940 | David H. Wenrich | Gotthold Steiner |
| 1941 | James E. Ackert | Justin Andrews |
| 1942 | Henry E. Meleney | Rudolf W. Glaser* |
| 1943 | Henry E. Meleney | Rudolf W. Glaser* |
| 1944 | Henry E. Ewing | Benjamin Schwartz |
| 1945 | Asa C. Chandler | Donald L. Augustine |
| 1946 | Norman R. Stoll | Harold Kirby, Jr. |

*Secretary-Treasurer*

| | |
|---|---|
| William W. Cort | 1925; 1926; 1927; 1928; 1929 |
| Norman R. Stoll | 1930; 1931; 1932 |

*Secretary*

| | |
|---|---|
| Horace W. Stunkard | 1933–34; 1935–36; 1937 |
| Oliver R. McCoy | 1938–39; 1940–41; 1942 |
| James T. Culbertson | 1942–43; 1944–45; 1946–47 |

*Treasurer*

| | |
|---|---|
| Austin Andrews | 1933–34; 1935–36 |
| Gilbert F. Otto | 1937–38; 1939–40; 1944 |
| L. E. Rozeboom | 1941–42; 1943–44 |
| Robert M. Stabler | 1945–46; 1947 |

*Council Members at Large*

| | | | |
|---|---|---|---|
| Paul Bartsch | 1925–28 | W. B. Herms | 1930–33 |
| Fred C. Bishopp | 1925–28; 1929–30 | Benjamin Schwartz | 1930–33 |
| Robert Hegner* | 1925–27 | L. R. Cleveland | 1931 |
| Charles A. Kofoid | 1925 | W. W. Cort | 1931–34; 1935–38 |
| B. H. Ransom* | 1925 | H. E. Ewing | 1931–32 |
| William A. Riley | 1925–26; 1928–30 | Ernest C. Faust | 1931–34; 1938–41 |
| Charles W. Stiles* | 1925; 1929–32 | John F. Kessel | 1932–35 |
| Ernest E. Tyzzer | 1925–26 | D. H. Wenrich | 1932–35; 1936 |
| Maurice C. Hall* | 1926–29 | H. E. Meleney | 1933–36 |
| Wilson G. Smillie | 1926–27 | Norman R. Stoll | 1933–36; 1937–40; 41 |
| Henry B. Ward* | 1926–29 | Eloise B. Cram | 1934–37 |
| Franklin D. Barker* | 1927–30 | Wilbur A. Sawyer | 1934–37 |
| J. H. St. John* | 1927–28 | James E. Ackert | 1935–38 |
| W. H. Taliaferro | 1928–31 | Earl C. O'Roke | 1936–39 |
| Asa C. Chandler | 1929–30; 1936–39 | Justin Andrews | 1937–40 |
| Harley J. Van Cleave | 1938–41 | Willard H. Wright | 1942–45; 1946 |
| Elery R. Becker | 1939–43 | Harold W. Brown | 1944–47 |
| Emmett W. Price | 1939–43; 1944–46; 1947 | Harold W. Manter | 1944–46 |
| Clay G. Huff | 1940–43; 1944–46 | G. Robert Coatney | 1945 |
| Horace W. Stunkard | 1940–43 | T. W. M. Cameron | 1946 |
| Donald L. Augustine | 1941–44 | Martin D. Young | 1947 |
| Raymond M. Cable | 1942–45 | Cornelius B. Philip | 1947 |
| Gilbert F. Otto | 1942–44; 1945 | | |

*Editorial Committee of the Journal of Parasitology*

| | | | |
|---|---|---|---|
| William W. Cort, *Chairman* | 1932–37 | Norman R. Stoll, *Chairman* | 1938–42; 1943 |
| Robert Hegner* | 1932–34 | William A. Riley | 1934–37; 1938–42; 1943; 1944 |
| Francis M. Root* | 1932–34 | William H. Taliaferro | 1934–37; 1938–42; 1943 |

* Deceased.

HORACE W. STUNKARD, *Chairman* 1944
DAVID H. WENRICH 1944

*Editorial Board of the Journal of Parasitology*

| | | | |
|---|---|---|---|
| CHARLES F. CRAIG | 1932–33; 1934–37 | CORNELIUS B. PHILIP | 1939–42 |
| MAURICE C. HALL* | 1932–33 | ERNEST E. TYZZER | 1939–42 |
| HENRY B. WARD* | 1932–33 | HAROLD W. BROWN | 1940–43 |
| ASA C. CHANDLER | 1932–34; 1935–38; 1939–42 | HAROLD W. MANTER | 1940–43 |
| | | REGINALD D. MANWELL | 1940–43 |
| CHARLES A. KOFOID* | 1932–34; 1935–38 | RICHARD P. HALL | 1941–44 |
| WILLIAM A. RILEY | 1932–34 | E. HAROLD HINMAN | 1941–44 |
| W. H. TALIAFERRO | 1932–34 | JUSTUS F. MUELLER | 1941–44 |
| JAMES E. ACKERT | 1932–35 | HAROLD KIRBY | 1942–45 |
| RICHARD P. STRONG | 1932–35; 1936–39 | BENJAMIN G. CHITWOOD | 1943–46 |
| FRED C. BISHOPP | 1932–36 | PINCUS P. LEVINE | 1943–46 |
| GEORGE P. LARUE | 1932–36 | RUDOLF GLASER | 1943–46 |
| DAVID H. WENRICH | 1932–36; 1938–41 | LOWELL T. COGGESHALL | 1944 |
| ERNEST C. FAUST | 1933–37 | JOHN T. LUCKER | 1944 |
| BENJAMIN SCHWARTZ | 1933–37; 1938–41; 1942–45 | NORMAN R. STOLL | 1944 |
| | | WILLIAM L. JELLISON | 1945 |
| ELERY R. BECKER | 1934–35; 1936–39 | CHARLES W. REES | 1945 |
| ROBERT MATHESON | 1935–38 | LLOYD A. SPINDLER | 1945 |
| OLIVER R. MCCOY | 1936–39 | RAYMOND M. CABLE | 1946 |
| HENRY E. EWING | 1937–40 | LLOYD E. ROZEBOOM | 1946 |
| JOHN F. KESSEL | 1937–40 | RICHARD J. PORTER | 1947 |
| HARLEY J. VAN CLEAVE | 1937–40 | WILLIAM TRAGER | 1947 |
| WILLIAM W. CORT | 1938–41; 1942–45; 1946 | ARTHUR C. WALTON | 1947 |

*List of Meeting Places*

| | | | | | |
|---|---|---|---|---|---|
| 1925 | Kansas City | 1933 | Boston | 1940 | Philadelphia |
| 1926 | Philadelphia | 1934 | Pittsburgh | 1941 | Dallas |
| 1927 | Nashville | 1935 | St. Louis | 1942 | (New York, cancelled) |
| 1928 | New York | 1936 | Atlantic City | 1943 | (No meeting) |
| 1929 | Des Moines | 1937 | Indianapolis | 1944 | Cleveland |
| 1930 | Cleveland | 1938 | Richmond | 1945 | St. Louis |
| 1931 | New Orleans | 1939 | Columbus | 1946 | Boston |
| 1932 | Atlantic City | | | | |

* Deceased.

## IN MEMORIAM

Rudolf W. Glaser
Seymour Hadwen*
Charles A. Kofoid*†
Samuel Morris
Harry Plotz

# AMERICAN SOCIETY OF PARASITOLOGISTS

## LIST OF MEMBERS[1]

### *Honorary Foreign Members*

BACIGALUPO, JUAN, Facultad de Medicina, Buenos Aires, Argentina.
BAYLIS, HARRY A., British Museum (Natural History), Cromwell Road, London, S.W. 7, England.
BRUMPT, ÉMILE, Laboratoire de Parasitologie, Faculté de Médicine, 15, Rue de l'École de Médicine, Paris VI, France.
MARTINI, ERIC, Institut für Schiffs-und Tropenkrankheiten, Hamburg, Germany.
SERGENT, EDMOND, L'Institut Pasteur d'Algérie, Algérie, North Africa.
SKRJABIN, KONSTANTIN I., Institut d'Helminthologie de l'École Vétérinaire, University of Moscow, Russia.
SWELLENGREBEL, N. H., Institute for Tropical Hygiene, Mauritskade 57, Amsterdam, The Netherlands.
TRAVASSOS, LAURO PEREIRA, Instituto Oswaldo Cruz, Rio de Janeiro, Brazil.
WENYON, CHARLES MORLEY, Wellcome Research Institution, 183 Euston Road, London, England.

### *Active Members*

One life member, indicated by †
Charter members indicated by *

*ACKERT, JAMES E., Department of Zoology, Kansas State College of Agriculture and Applied Science, Manhattan, Kansas.
ADAMS, ALFRED J., New York State Agricultural Experiment Station, College Road, Poughkeepsie, New York.
ALICATA, JOSEPH E., Hawaiian Agricultural Experiment Station, Honolulu, Territory of Hawaii.
ALLEN, P. EVELYN, Department of Parasitology, Johns Hopkins University, Baltimore 5, Maryland.
ALLEN, REX W., Zoological Laboratory, 908 Custom House, Chicago 7, Illinois.
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*ANDREWS, JUSTIN M., U. S. Public Health Service, 605 Volunteer Building, Atlanta, Georgia.
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ATCHLEY, FLOYD O., Department of Biology, Defiance College, Defiance, Ohio.
*AUGUSTINE, DONALD L., Department of Comparative Pathology, Harvard Medical School, Boston, Massachusetts.
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BAKER, DONALD W., Parasitological Laboratory, New York State Veterinary College, Cornell University, New York.
BAKER, EDWARD WILLIAM, U. S. Bureau of Entomology, U. S. National Museum, Washington, D. C.
BAKER, ROLLIN H., Museum of Natural History, University of Kansas, Lawrence, Kansas.

[1] As of November 1, 1947. The last preceding list of members was published in the Journal of Parasitology, 1942, **28** Supplement: 41. Earlier lists appeared in the Journal of Parasitology in 1926, **12:** 170 and in 1934, **20:** 345.

BALAMUTH, WILLIAM, Department of Zoology, Northwestern University, Evanston, Illinois.
*BALL, GORDON H., 405 Hilgard Avenue, University of California, Los Angeles, California.
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BLACK, JAMES J., Poultry Laboratory, c/o Landis & Brewster, Vineland, New Jersey.
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BOUGHTON, DONALD C., Grasselli Chemicals Department, E. I. du Pont de Nemours Company, Wilmington, Delaware.
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*BROOKS, FRANK G., Cornell College, Mount Vernon, Iowa.
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*CARROLL, MITCHELL, Department of Biology, Franklin and Marshall College, Lancaster, Pennsylvania.

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*CHANDLER, ASA C., Department of Biology, Rice Institute, Houston, Texas.
CHAPMAN, J. W., Walterboro, South Carolina.
CHAUHAN, B. S., Zoological Survey of India, Kaiser Castle, Benares, India.
CHAVEZ-GARCIA, CARLOS E., Faculty of Veterinary Medicine, Las Palmas, Barranca, Lima, Peru.
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†*CRAIG, CHARLES F., 239 West Lullwood Avenue, San Antonio, Texas.
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DAVIS, HELEN EDITH, Department of Zoological Sciences, University of Oklahoma, Norman, Oklahoma.
DAVIS, LEONARD R., Regional Animal Disease Research Laboratory, U. S. Bureau of Animal Industry, Auburn, Alabama.
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DeVolt, Harold Moon, University of Maryland, Department of Pathology, College Park, Maryland.
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*Dove, Walter E., Defense Highway, Gambrills, Maryland.
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*Drake, Carl J., Science Building, Iowa State College, Ames, Iowa.
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Dunn, Mary Catherine, Culver Stockton College, Canton, Missouri.
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Edgar, Allen S., Poultry Department, Alabama Polytechnical Institute, Auburn, Alabama.
Eisenbrandt, Leslie L., Department of Biology, University of Kansas City, Kansas City, Missouri.
ElGindy, Mohammed S., 611 Church Street, Ann Arbor, Michigan.
Elishewitz, Harold, Munoz A Pedrera 40, Caracas, Venezuela.
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### Announcements

Horace W. Stunkard, who has served as Chairman of the Editorial Committee of the Journal of Parasitology for the past four years, will have sabbatical leave from New York University from February to September, 1948. Consequently, W. W. Cort will serve as Chairman of the Editorial Committee and managing editor of the Journal of Parasitology during 1948 (volume 34). Manuscripts and correspondence concerning editorial affairs may be addressed to him: Professor W. W. Cort, Department of Parasitology, Johns Hopkins University, Baltimore 5, Maryland.

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